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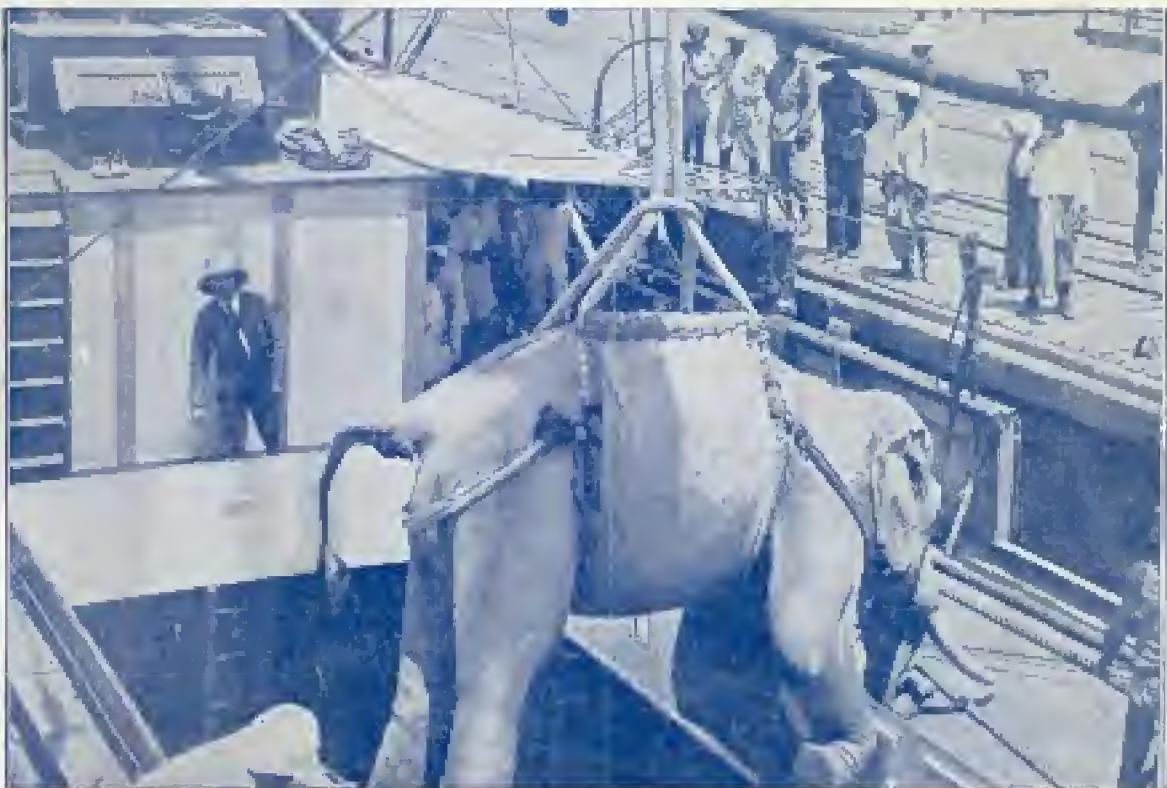
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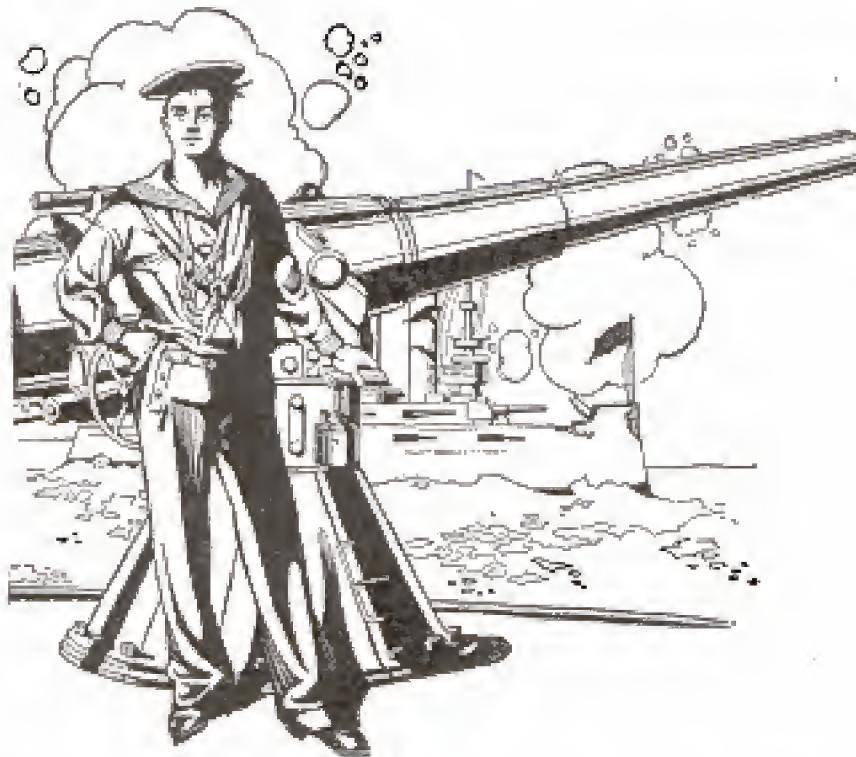
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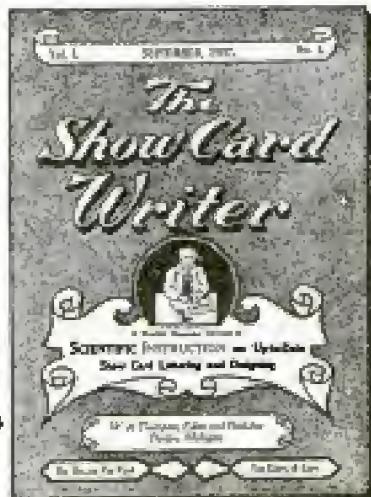
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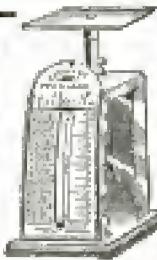
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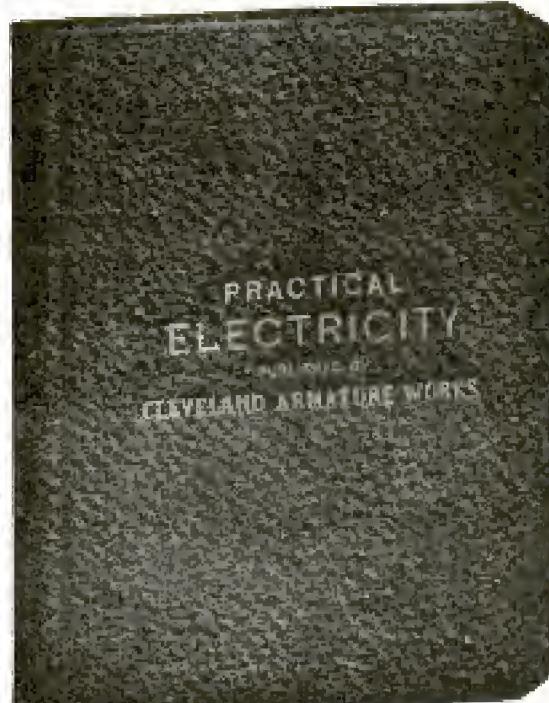
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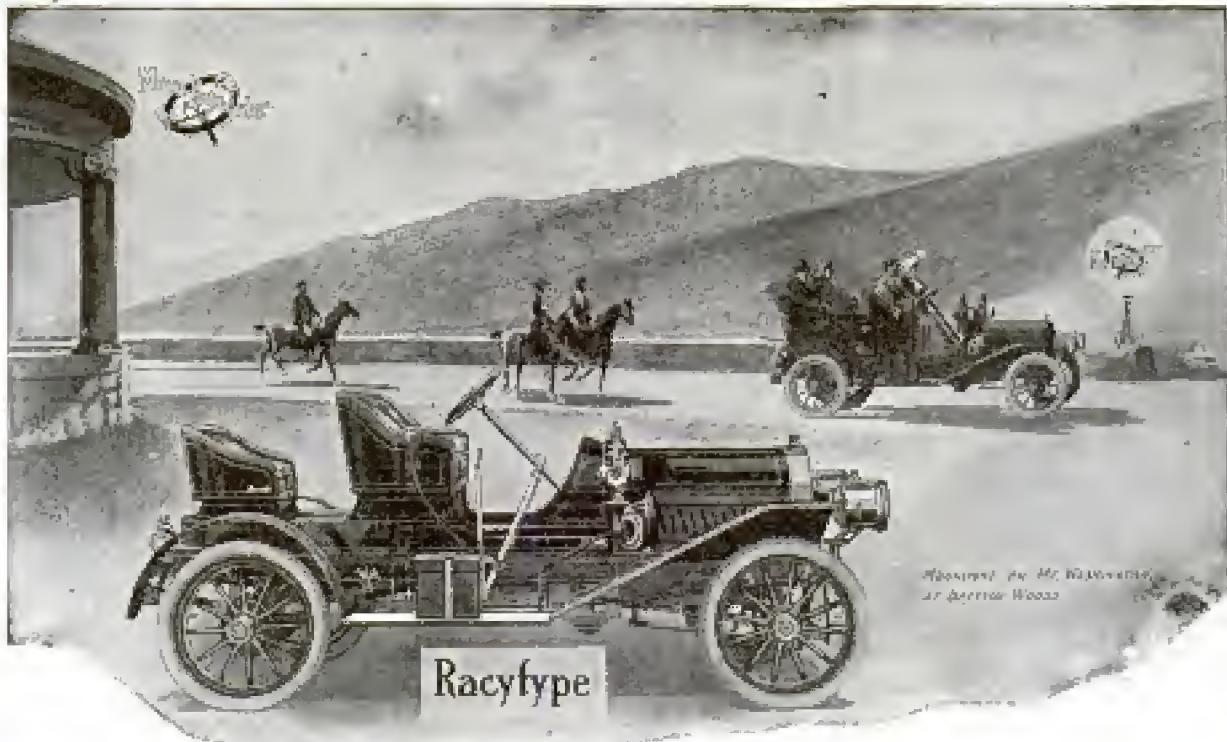
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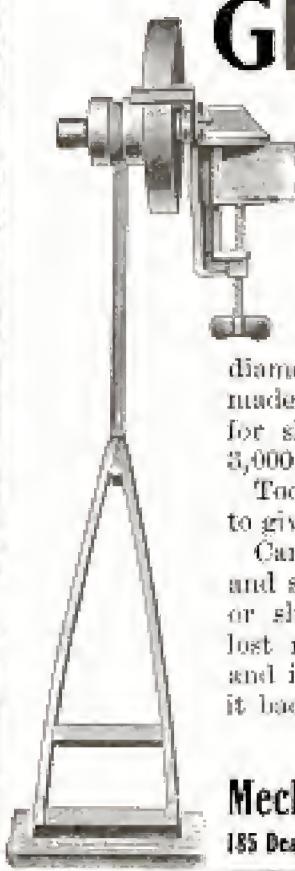
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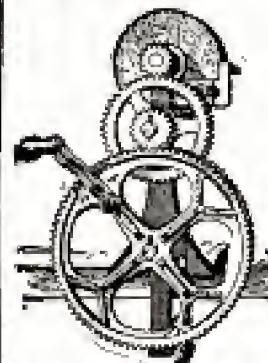
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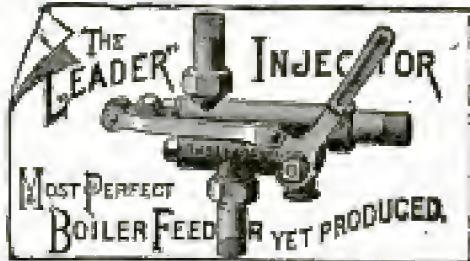
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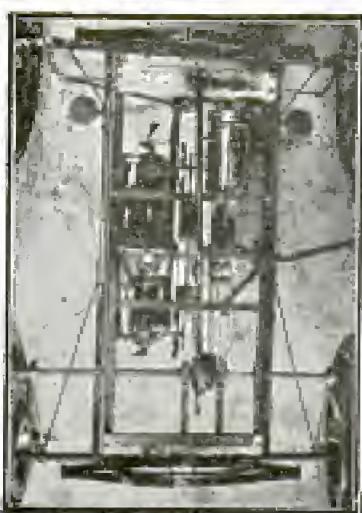
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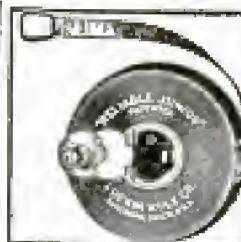
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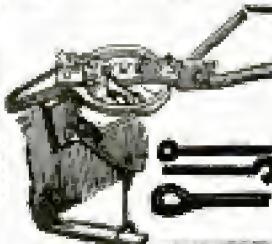
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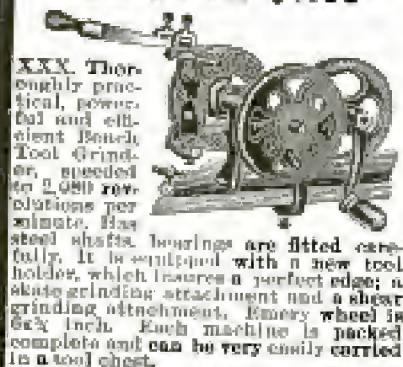
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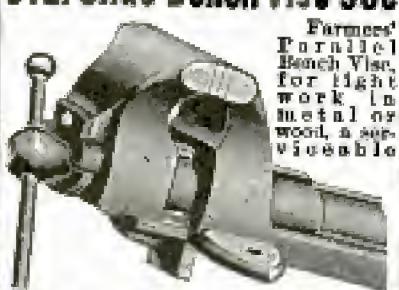
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POPULAR MECHANICS

Vol. 10. No. 1.

CHICAGO, JANUARY, 1908.

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THE GREAT AMERICAN WATERWAY

Mid-Continent Lakes-to-Gulf Project--The Proposed Route--Costs Four Times as Much to Build as a Railroad, but Will Transport Freight at One-Seventh Present Rail Rates

Throughout the entire length and breadth of the Mississippi Valley and its tributaries, far-seeing men, versed in statecraft and in business, are directing their brains and energies toward the successful continuance and ultimate completion of the greatest waterway project ever undertaken within the boundaries of the United States--The Deep Waterway from the Great Lakes to the Gulf of Mexico.

Combine with this the waterway projected to run directly across Canada from Lake Huron to Montreal and the Atlantic coast, via Georgian bay and the Ottawa river, which the Canadian government is now ready to undertake at a cost of \$100,000,000, and it is easily seen that one of the most salutary eras of the commercial and industrial history of the United States and Canada is now in the making.

When these two waterways are completed the benefit to the middle west will be almost incalculable. The output of the industrial activities and the products of the western farmer can then be shipped from the Great Lakes ports or the cities of the Mississippi valley through the "Lakes to the Gulf" waterway to the Gulf of Mexico. From there the ships can continue southward without breaking bulk to Central and South American ports, or, passing through the Panama canal, proceed along the Pacific coast. Eastward bound the distance by water from Chicago to Montreal and tide water, via the



From a photograph, Copyright, 1907, Underwood & Underwood

The "Hertwig"--Type of Present River Freighter

POPULAR MECHANICS

Georgian bay and Ottawa river waterway, will be no further than from Chicago to Buffalo through Lake Erie and Lake Ontario.

Today the first stage of the waterway, the Chicago sanitary and ship canal, has been practically completed at a cost of \$55,000,000 to the Chicago Sanitary District. This canal proper is 22 miles long, besides 6 miles of the Chicago river and 8 miles of the Desplaines river, making a total length of 42 miles. The canal now finished is 22 ft. in depth and 200 ft. wide. The Sanitary District has yet to complete the short stretch of canal from Lockport to Joliet, which work will cost about \$3,000,000.

The proposal of the trustees of the Chicago Sanitary District is to turn over to the government this magnificent ship canal, which has cost nearly one-third of the estimated cost of the entire undertaking, as a voluntary offering, without other consideration than that the federal government complete the canal from Joliet to St. Louis. This offer is now "tabled" at Washington, awaiting further developments at the hands of the deep waterways commission.

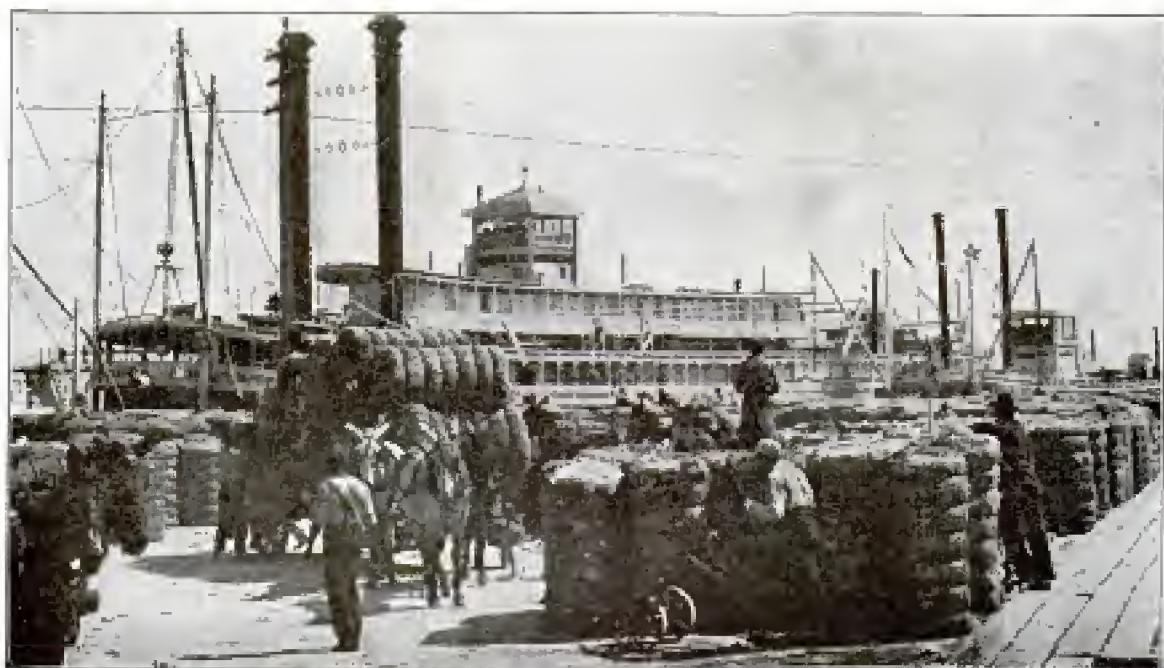
The second section, embracing the route from Joliet to St. Louis through the Illinois river, is 230 miles in length. The cost of a 14-ft. waterway through it, with the canal work necessary, is estimated at \$31,000,000.

The third section, between St. Louis and Cairo, Ill., a distance of 186 miles, is now being surveyed. This stretch of the system will be the most expensive, as it will be necessary to build a canal parallel with the Mississippi for the entire distance, instead of as part of it; the river bed being too uncertain to insure an uninterrupted channel. The estimated cost of this section is \$73,000,000.

The fourth section, from St. Louis to the Red river through the Mississippi, a distance of 764 miles, will require no more work than the ordinary dredging. The fifth section to New Orleans presents comparatively few difficulties. The estimated total cost of the undertaking, in addition to the \$55,000,000 spent by the Chicago Drainage District, will be about \$125,000,000. The length of the waterway will be 1,625 miles.

As the figures show, the cost of the undertaking will be enormous, but the resultant good will be so much greater that in years to come the outlay will be considered only a drop in the bucket compared to the benefits accruing therefrom.

It is estimated that 80 per cent of the entire cost of living is expended for



Photograph, Copyright, 1907, by Underwood & Underwood

Levee Scene on the Mississippi River, at Memphis



Engraving, Copyright, 1897, Universal & Univeral

Present type of boats and system of transferring freight on Mississippi River. Unloading cotton at New Orleans. These boats and methods will largely give place to those shown on Page 5, when the Deep Waterway is completed.

the transportation of goods and persons from place to place. A large proportion of the goods transported costs less than \$2 a ton at the point of production. With this figure in mind anyone can calculate with reasonable accuracy the tax imposed by the transportation companies. The cost of transporting freight by rail is $7\frac{1}{2}$ mills per ton-mile, while the cost of carriage by water is from .92 of a mill on the Great Lakes to .1 mill on the Ohio and Mississippi rivers. Transportation by water is also more rapid than by the average freight car service. For instance: The rate on coal from Pittsburg to Lake Erie by rail, a distance of 135 miles, is 90 cents a ton, while the rate by water from Lake Erie to Duluth, a distance of 1,000 miles, is only 35 cents.

The people of the South American countries are purchasers of the products of the United States to the extent of \$40,000,000 annually, while the purchases of the United States from them are more than double that amount. With direct water communication between the heart of the American continent and South and Central America, so that vessels loaded at the ports of these countries could, without breaking bulk, discharge their cargoes at ports on the shores of the upper Mississippi and the Great Lakes, it is hardly possible to form an estimate of the impetus that would be given to the central west.

The building of the "Lakes to the Gulf" waterway will be followed by wonderful development. The Mississippi itself is navigable for steamboats for 2,161 miles, while small boats go 650 miles further. It has 55 navigable tributaries, the aggregate length of which is 16,000 miles.

While the average construction cost per mile of the canals of this country is about four times that of the railroads, the outlay for equipment and cost of operation is so much in favor of the waterway that there is hardly any comparison between the two methods of transportation.

The possibilities of water transportation with flat-bottom steamers and barges is illustrated in the trip of the river steamer "Sprague," which passed Memphis with a fleet of 56 barges containing 50,000 tons of soft coal. The fleet was 1,132 ft. long by 312 ft. wide, and handled by the one steamer with a crew of 25 men. To transport this cargo by rail would require 1,000 cars of 50 tons capacity each, making 25 trains of 40 cars each. The cost of equipment in these cars and locomotives alone would be \$1,350,000 and require 125 men for train crews on each division of the road.

The proposed waterway is also needed to furnish an outlet to the shipbuilding interests of the Great Lakes. With cheap iron plates and an entrance to tide water, the inland shipbuilders could compete with any shipbuilding concern in the world. Steel plates cost in England 30 per cent less than in this country, but with these plates made in the west by the cheap assembling of coal, and iron ore upon the lake shore, no shipwright anywhere could undersell in the shipbuilding industry.

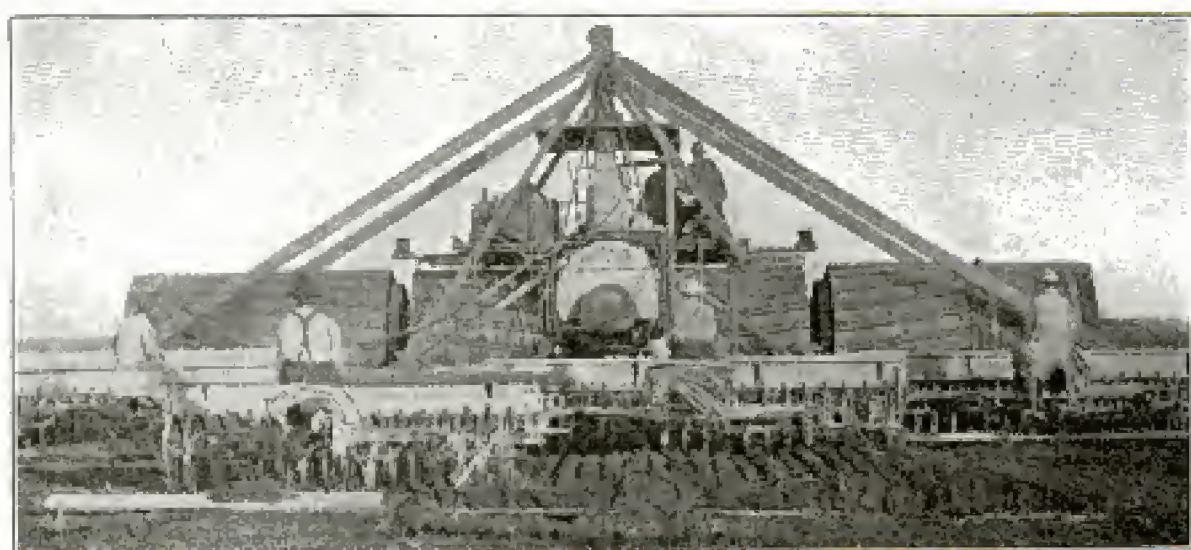
One of the chief obstacles to the waterway was overcome last November when the Canadian government practically withdrew its contention that such a waterway would lower the level of the Great Lakes.

At the Deep Waterways convention held at Memphis, Tennessee, President Roosevelt in his address on the waterway question said:

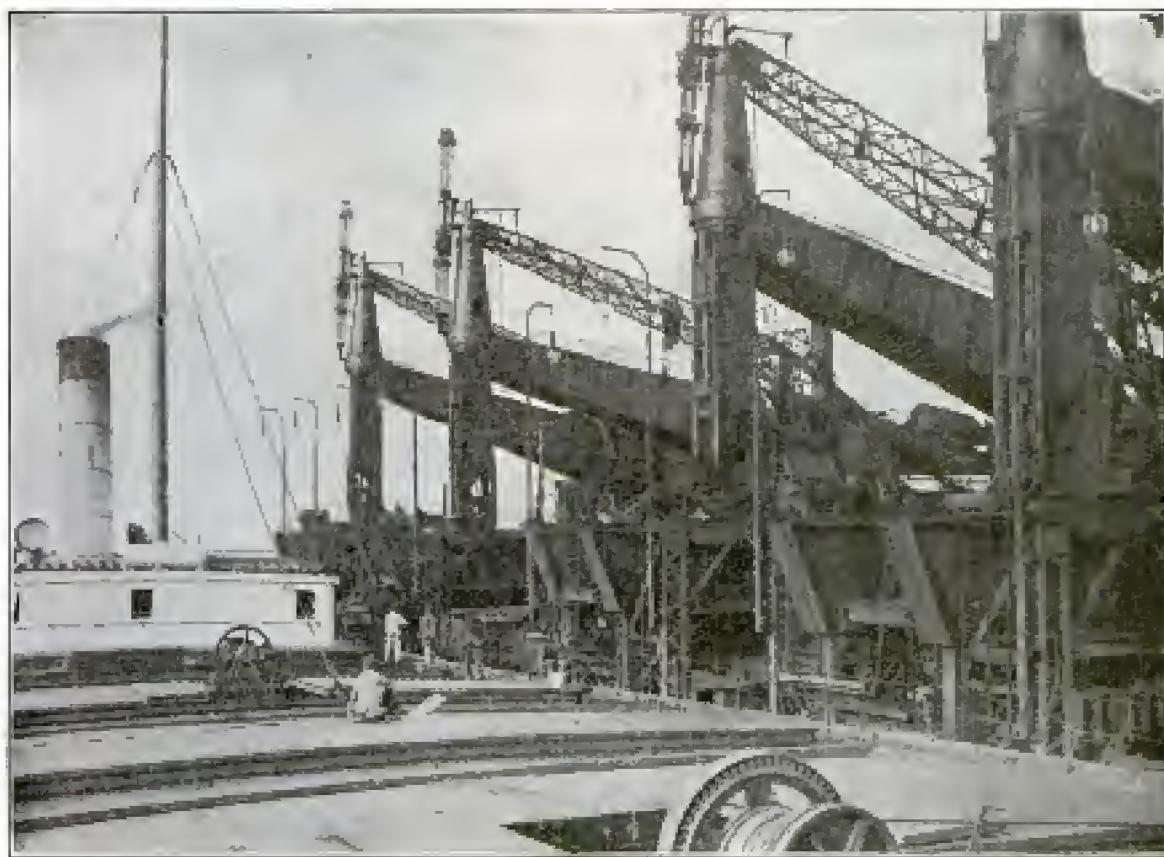
"The wonderful variety of resources to be found in different portions of the Mississippi valley makes the demand for transportation altogether exceptional. Such being the case, and this valley being the heart of the United States, the Mississippi and all its tributaries ought to be utilized to their utmost possibility. Facility of cheap transportation is an essential in our modern civilization and we cannot afford to any longer neglect the great highways which nature has provided for us. Natural resources have been and are still being abused, and we have at last reached the forks of the roads. Lands, forests and streams will have to be conserved, and the nation must solve the problem."

HUGE TRACTION ENGINE

This extraordinary traction engine and soil-tilling equipment was built



This Mammoth Machine Plows, Harrows and Plants a Strip 44 Ft. Wide at One Time; an Average of 100 Acres per Day



Copyright, 1907, Detweiler & Detweiler

Hydraulic unloading machines on docks at Cleveland, O., which will lift 10 tons at a time. Boat sea-going type. These will take the place of the boats and men seen on Page 3.

especially for work on the soft peat land reclaimed from the San Joaquin river west of Stockton, Cal. It has two main wheels, both of which are 7 ft. 6 in. in diameter and 6 ft. wide, and two auxiliary wheels of the same proportions. When used for plowing each auxiliary wheel has a 6-ft. extension, forming a bearing surface 36 ft. wide. The width of tread is 44 ft. 4 in.

In this illustration the machine is plowing, seeding and harrowing a strip of land 44 ft. wide at an average of nearly 100 acres a day.

THE ROLLING STOCK OF RAIL-ROADS

Approximately 300,000 freight cars and 6,000 locomotives were manufactured in the United States in 1906 for use on the railroads of the country. The lumber for these cars involved a consumption of about 1,000,000,000 ft. of timber. To transport the ma-

terial used in the construction of both cars and locomotives at least 200,000 cars were used. Add to this figure the number of cars required to haul the material for bridges, ballast, ties, steel rails, etc., while the railroads have been making improvements and extensions on a grand scale, and one of the reasons for a shortage in cars is accounted for.

STEEPLE-JACK WORKS 672 FT. ABOVE GROUND

E. Capelle, the steeple-jack who painted the steel flag pole which towers 60 ft. above the top of the Singer building, 612 ft. in height, met with many thrilling experiences. The wind velocity at that great height ranged from 10 to 40 miles an hour when no perceptible movement of air was felt below. With a stiff breeze blowing nearer the ground, a velocity of from 40 to 80 miles an hour made itself felt where the steeple-jack was at work. In the

latter instance the pole swayed in a radius of about one foot. Contrary to the general impression, this movement is an indication of strength. A flag pole or steeple which does not bend is dangerous because likely to snap and fall.

TREADMILL TO BE ABOLISHED

It will surprise our readers to learn that there is any such relic of a bar-



Present Day Treadmill

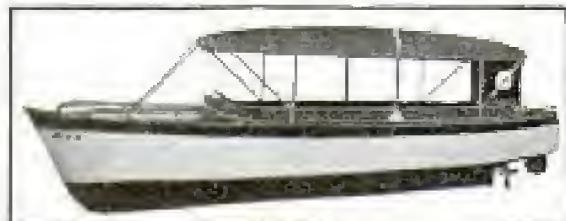
barous civilization to abolish. Such, however, is the case, and in some of the English prisons the treadmill is this moment turning its monotonous course. Its power serves no other useful purpose than prison discipline.

When a prisoner enters upon his sentence he is given two days at the tread. He does not return to it unless he violates some rule of the institution, and it is said to be an excellent promoter of good behavior, for the recollection of the first experience is not soon forgotten. The guard sits on a lever which acts as a brake to keep the machine from moving too rapidly. The speed is graduated to about 30 steps a minute. If a man misses a step he is

carried down to where a crossbar strikes the calves of his legs, which has an instantly stimulating effect. The performance is like climbing the steps of an endless skyscraper, and ascending at the rate of about 1,000 ft. per hour. The subject is now being agitated, with the probable result that the treadmill will be abolished.

CARRIAGE TOP FOR BOAT

A removable top for motor boats built on the same lines as a carriage top is a recent novelty. The top is made



It Folds up Quickly

of waterproof leather or canvas, as preferred, mounted on a frame which can quickly be taken down and folded up. Side curtains button on.

BLOWING OFF A GAS WELL

Salt water finds its way into the Texas natural gas wells and is forced up to the top in small quantities. About once a week enough accumulates so it has to be blown out, with the result shown in the illustration. The force of the gas sends the water about 15 ft.



Emptying a Gas Well

ELECTRIC HOUSEHOLD UTENSILS

While Marconi has been working night and day on a system of wireless telegraphy that is this moment flashing commercial messages across 2,400 miles of ocean, scores of other as earnest inventors have been perfecting electrical devices of practical everyday domestic utility. The names of these inventors are not heard or known outside the electrical trades, but where one woman sends or receives a wireless message, thousands of others will be making use of an electric dishwasher, flatiron or kitchenette.

Machinery which has lightened the hardest labor of the farmer, miner and all other industries which were once laborious and severe, has at last been adapted to the less strenuous but exhausting household work, and electricity has proved to be the medium. To such extent have the labor-saving devices been developed, there is now scarcely anything to be done about the house which cannot be performed by turning a switch or touching a button: Cleaning, sweeping, washing, heating, cooking, chopping,—all these and many more are now done without the expenditure of any strength. The wire that brings in the light brings also a tireless, ever-ready force which instantly responds to every call by day or night.

In order to actually show the workings of electric household utensils, many electric service companies have fitted up a demonstration room at convenient places, where the public may come to see and learn. One of these exhibits is shown in the illustration below, where the practical utilities and labor-saving possibilities of electric utensils for a modern residence are seen in operation. The electric flat iron, the meat chopper, with roasters, bakers, and a great variety of



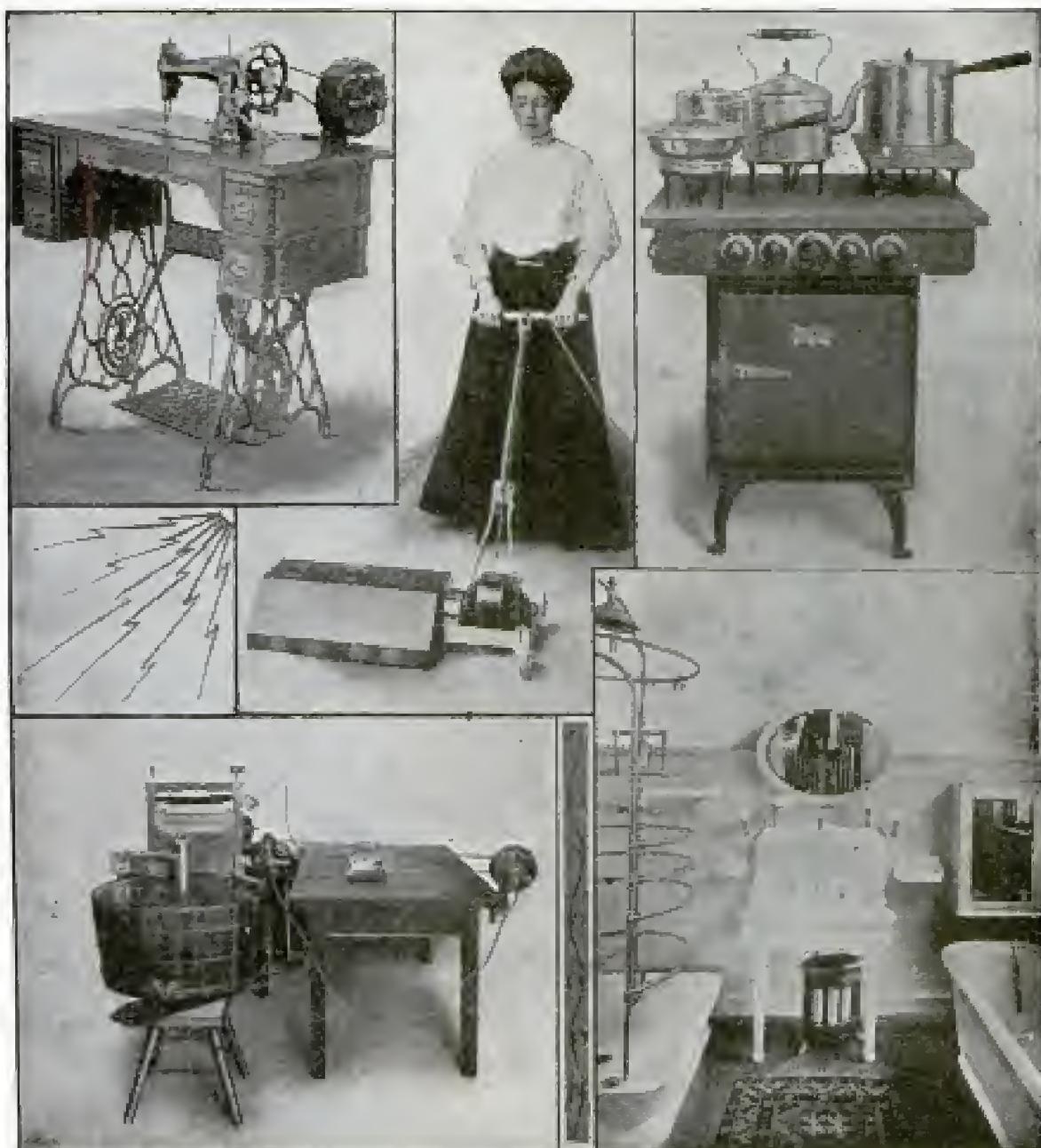
Demonstration Room—Free Lessons in Electric Cooking

other cookers are all there. No fire to wait on a tardy supply of kindling, no chimney which fails to draw, no oven which refuses to heat to the necessary temperature. Instead we find a row of switches by means of which ten fires can be kindled in as many seconds, and each fire instantly attains the desired amount of heat. No coal or wood to bring in, no ashes to remove with the accompanying dust and dirt, and when the fire is no longer needed it is put out as quickly as it came. Meanwhile a bright light making the room cheerful, and an electric fan to keep it cool, has helped to make the electric kitchen a joy and a satisfaction. Not so many years ago it would have ranked as a marvel of passing wonder.

For the heavier work of operating the washtub and wringer, running the



Household Electric Utensils Now Coming into General Use



Sewing Machines, Sweepers and Wringers Run by Motors

sewing machine, or driving the floor polisher and sweeper, there are motors which require no effort and are as easy to operate as a front door bell.

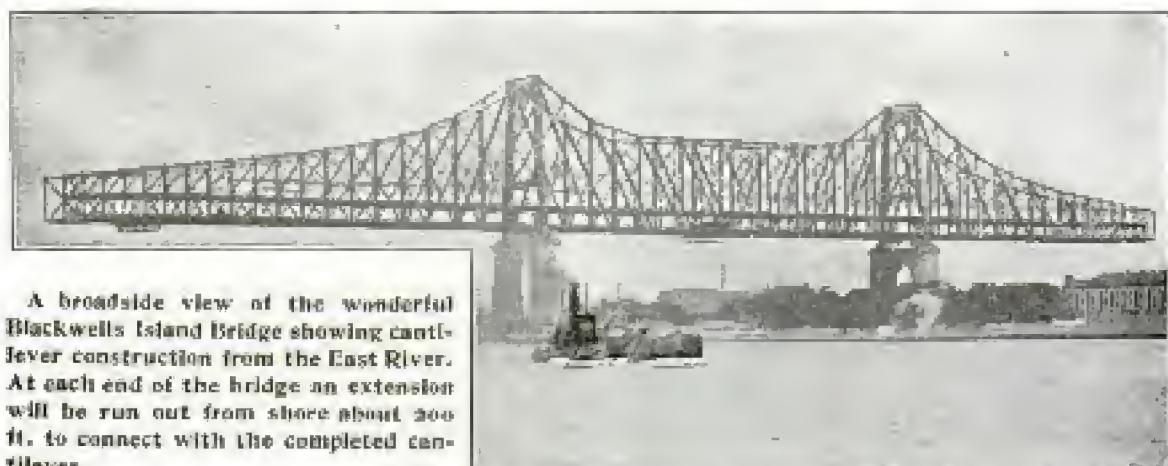
Automobiles, airships, and submarines were all predicted half in earnest, half in jest, a century or more before they were achieved, but no prophet thought to foretell or dared to voice the coming of the day when the weary duties of daily housekeeping should be largely robbed of their terrors.



OCEAN TRAVEL IN 1907 BREAKS RECORD

All records in the transportation of passengers across the Atlantic were broken during the first ten months of 1907, during which 2,000,000 traveled

across. If only \$40 were allowed as the average passage money, this volume of human traffic would represent an expenditure of \$80,000,000.

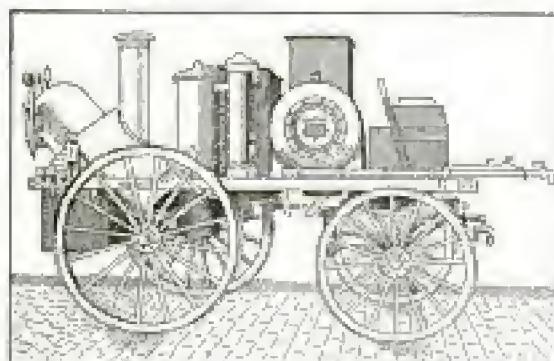


A broadside view of the wonderful Blackwells Island Bridge showing cantilever construction from the East River. At each end of the bridge an extension will be run out from shore about 200 ft. to connect with the completed cantilever.

Photo photograph Copyright 1907 by Underwood & Underwood, N. Y.

ARMY WATER STERILIZER

This portable army outfit for water sterilizing was turned over to the United States government in August. It has a capacity under test of 400 gal.

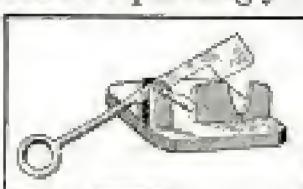


Capacity 400 Gal. per Hour

of water per hour, 270 gal. more than the requirement demanded by the government. Exhaust steam from the pump is used to operate the heater of the sterilizer.

NEW LAMB-TAILING INSTRUMENT

A new device is being manufactured in Australia for use by breeders in the task of separating young lambkins from their tails. This machine sears or burns the tail off in a simple and effective way. The knife has been the usual instrument used for this operation, but it is



always attended with loss of blood, which hinders the growth of the lamb.

STEEL FREIGHT CARS IN INDIA

The freight cars on the Bengal-Nagpur railway in India are small compared to the freight cars of this country, and resemble somewhat a large covered wagon. The body of the car



Steel Car Used in India

is constructed of light steel plates and the flooring is made of teak-wood boards. This car is used for heavy goods traffic and carries a load of 32 tons. The ends of the car are fitted with ventilators.

The Hamburg-American liner "Borussia", running between Hamburg and Brazil, foundered recently while coaling. A strong tideway caused the ship to list and the water rushed into her coaling ports.

GERMANY AND FRANCE BATTLE FOR AIR-SHIP SUPREMACY

Military Dirigible Balloons of Both Nations in Wonderful Flights--Talk of Prohibiting Foreign Air-Ships from Germany's Atmospheric Zone

Germany and France have for the past year been indulging in a duel of brains for the supremacy of the atmosphere, which, gradually gaining interest as first one and then the other tossed into the air a military dirigible air-ship of superior power and perfection, has done much to stimulate other nations to achievement in this line.

The changes are so rapid that one, not watching closely the efforts of the two countries, becomes lost in a maze as first one air-ship and then another is heralded as the best. Three months ago a German air-ship had made the longest flight. Then "La Patrie," the pride of the Parisians, in a wonderful flight, eclipsed anything hitherto accomplished by dirigible balloons. September 24 was ushered in by the ascension of a German air-ship which out-pointed the "Patrie" in distance and speed. Today, unless watching the duel to the very minute, you will not know which country holds the record.

Germany is straining every effort to gain the advantage and France is losing no time. One million dollars has been voted by France for the construction of a fleet of the "Patrie" type. Both Germany and France are frankly uneasy at each other's success. An air-ship of the "Patrie" type could fly over Germany and photograph all the German fortifications, and vice versa.



On the Deck of an Aerial Warship--1,500 Ft. Elevation

Germany is now stirred by the idea that considerations of national defense render it essential to regulate aerial navigation by legislation. One German military writer urges that foreign air-ships should be prohibited from sailing Germany's atmospheric zone even in times of peace, and that a law should be passed enabling the military authorities to destroy by artillery or otherwise all foreign air-ships perceived in the firmament above.

"La Patrie," the French air-ship, is a dirigible balloon about 250 ft. long over all. It can carry six men with ease, and two months ago was the near-

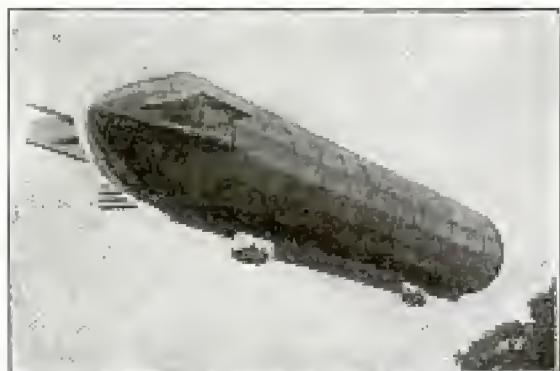


Spanish War Balloon in Flight

est approach to aerial navigation by a vessel lighter than the atmosphere. M. Clemenceau, the French premier, and Gen. Picquart, minister of war, made successful ascensions in the "Patrie." One of the most interesting flights of the French air-ship was accomplished under schedule. On August 8 the ship visited President Fallieres at his country seat at Rambouillet, 21 miles distant, arriving at the minute scheduled and at the exact spot designated for

the landing. The ship made the 21 miles in 45 minutes.

On July 23 one of the German dirigible balloons made a remarkable flight over Berlin, remaining in the air $3\frac{1}{2}$ hours, a quarter of an hour longer than the "Patrie's" record at that time. Both of these flights, however, were distanced on September 24 by the German air-ship under the command of Count Zeppelin, one of the inventors of the ship. He is 69 years of age and the oldest aeronaut ever in active control of an air-ship in flight. This dirigible balloon completely circum-



Zeppelin's "Dreadnaught" of the Air

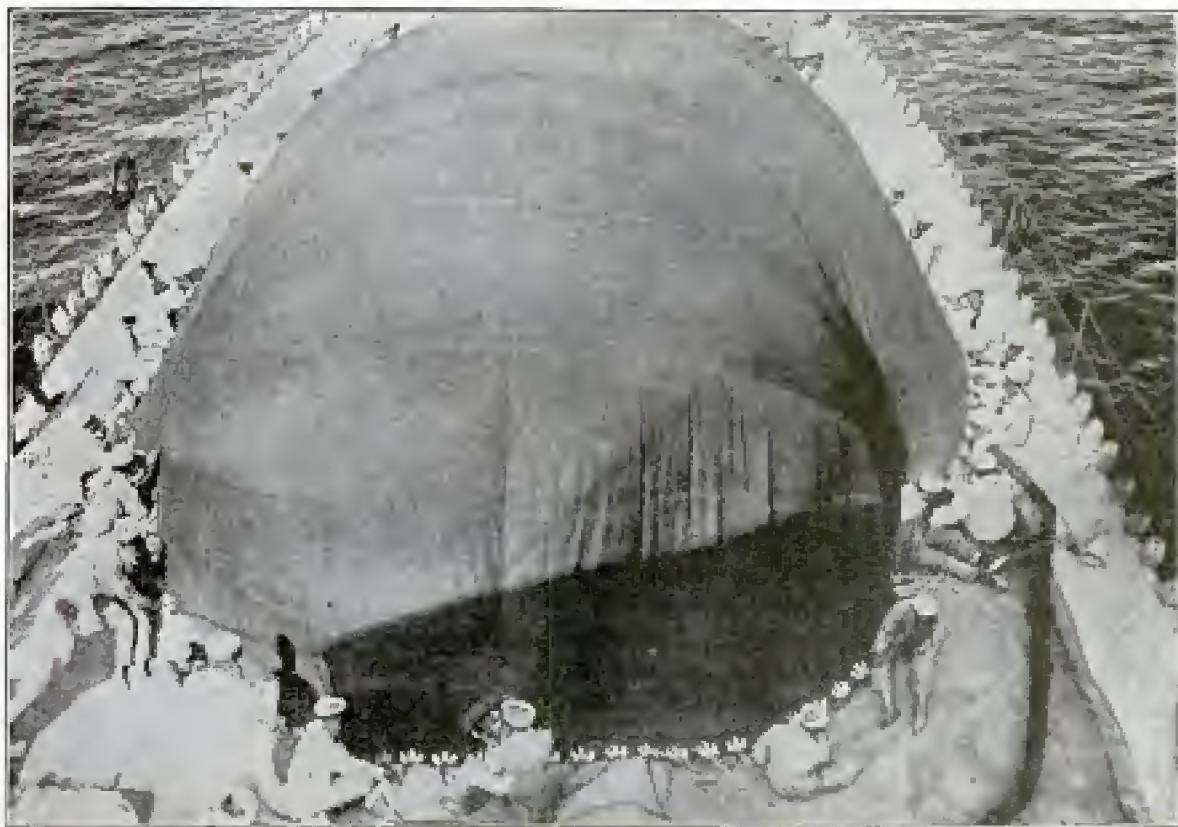
navigated the Lake of Constance and passed over five different states. The speed of the ship was estimated at about 38 miles an hour. The time spent in the air was 4 hours, 17 minutes.

When the battle for supremacy of the air commenced England was hardly considered as a rival and the United States even less so. Great Britain suddenly set to work, and a shadowy form arose, took shape, and England's first dirigible balloon unfurled the British flag, 1,500 ft. above the British isles in answer to France and Germany's challenge. Illustrations of the English air-ship were shown in previous pages of this magazine. In one of its recent flights the English air-ship crossed the Thames at Blackfriar's bridge and then circled around Trafalgar square, over the war office and past Westminster abbey and the houses of parliament.

The United States war department has recently decided to construct its first dirigible balloon, but no date has



Ascension of the Wellman Ship, 1907



Inflating the great war balloon "Dragon" on board the Italian battleship "Elba." The Italians are the first to adapt the balloon to naval work. The balloon, which was kept captive by the vessel, was sent up 300 ft., carrying two aeronauts who made observations during the naval manœuvres.

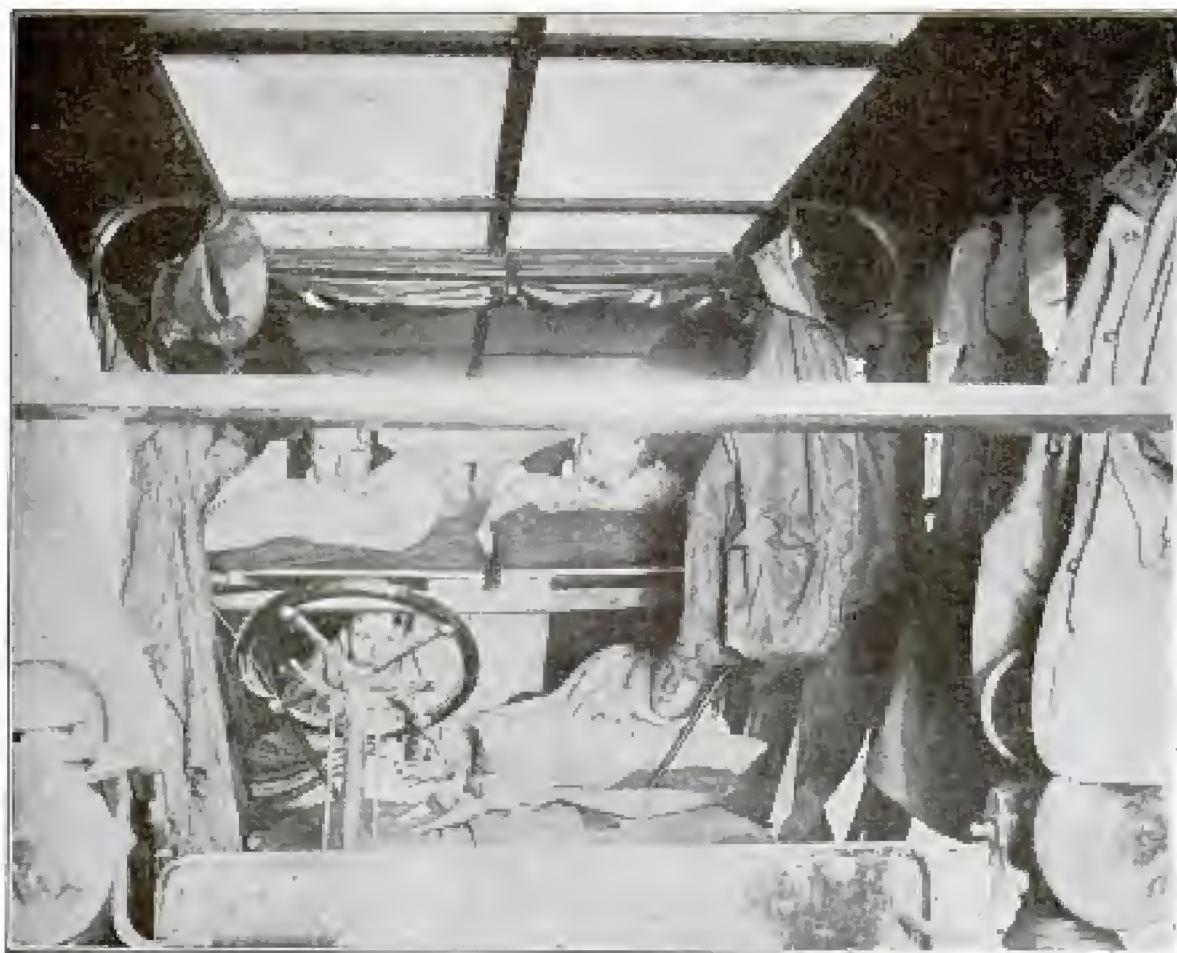
been given out as to when the construction will begin. It is expected that the American airship will bring into service all the foreign inventions and several added contrivances which are being kept secret by the government. Many of the details are withheld from

the public, as the policy of the war department is to keep as quiet as possible until the balloon is completed. According to present plans the dirigible balloon will be 190 ft. in length, have a capacity of 50,000 cu. ft. of gas, and run 35 miles an hour.

TESTING THE BIG NILE BRIDGE



After three years of work, the largest bridge across the Nile has just been completed from Cairo to the Island of Rodah. The bridge is 1,740 ft. long, and 65 ft. wide. The official test subjected the bridge, span by span, to a weight equal to 400 lb. per square yard. To accomplish the test 20 cars, 24 water carts, and 20 dust carts, all of which were loaded with cement, sand and water, and 8 steam rollers stood on each span for 24 hours. The entire procession crossed the bridge from end to end.



HUNTING IN AN AUTOMOBILE

Automobiles are being used for about everything these days by ingenious owners, from sawing cordwood and driving printing presses to carrying money in a Wall street panic, but the possibilities are not yet exhausted, apparently. Roy Faye, a Boston autoist, has converted his car into a traveling camp for hunting in the Maine woods. He has built an extension top of heavy waterproof canvas and fitted up the rear end of the interior with bunks for sleep-

ing quarters at night. Along the inside of the tonneau and canopy are arranged hooks on which to hang clothing and hunting accoutrements.

The berths in the car have been adjusted by widening their hangers $\frac{1}{4}$ in. This makes it possible to keep the beds made up ready to be dropped into place when needed. The blankets have been converted into semi-sleeping bags that fold up with the pneumatic mattresses in such a manner that they fall easily into place when the berths are lowered. A large canvas tent is taken along, which can be attached to the car and give additional quarters, making the whole as spacious a camp as any built for permanent use. The provisions are packed in chests in the body of the car, each chest having many compartments. Folding tables, cooking utensils arranged in nests for more convenient transportation, and other things add to the comfort of camping expeditions.



Extension Top Is Canvas

CABLE REPAIRING BUOYS

The two immense steel buoys recently added to the equipment of the big cable repairing steamer, "Restorer," stationed in Honolulu harbor, were used for the first time in repairing the break in the Pacific cable between Midway island and the island of Guam.

The buoys are 11 ft. high and 7 ft. in diameter at the middle. They weigh 8,600 lb. each. When submerged to a depth of 6 ft. each buoy will carry a weight of 14,391 lb. The buoys are made with three airtight compartments, with man-hole doors in each. One of these doors is through the outer shell at the top and the others inside on the bulkhead. The buoys are visible from the deck of a vessel 10 miles distant.

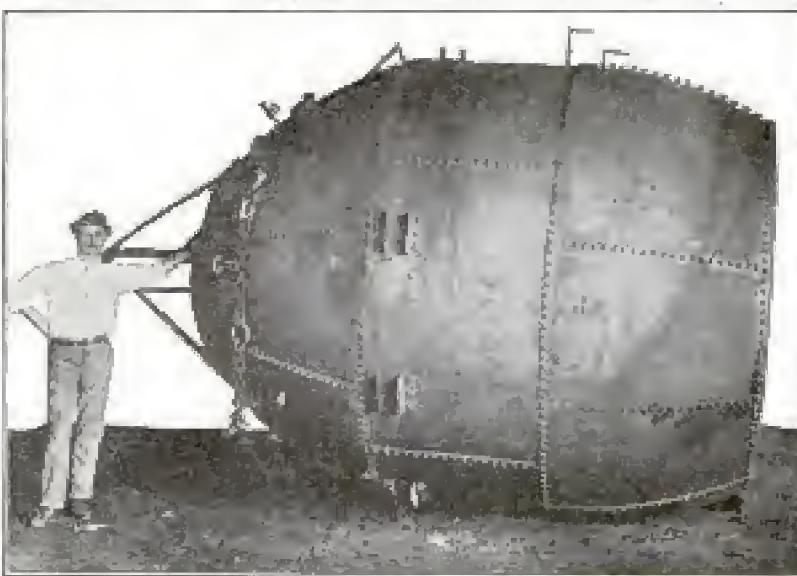
STEERED BY PROPELLERS

The North German Lloyd steamer "Kaiser Wilhelm der Grosse," en route from New York to Cherbourg, by way of Plymouth, England, lost her rudder in a raging storm when two and a half days out from New York. She steamed the rest of the distance to Plymouth, 1,750 miles, steered by her propellers alone. This was accomplished by alternately driving and stopping the screws on one side and then on the other.

HOW TO RESCUE MAN SINKING IN MARSH

The necessity for quick thinking, followed by as quick action, sometimes brings out a startling ability to cope with difficult situations. Recently, while a number of men were going to their work they saw the head of a man slowly sinking into a marsh near Williamsburg, Pa. The mire was in the bed of a narrow creek and the men

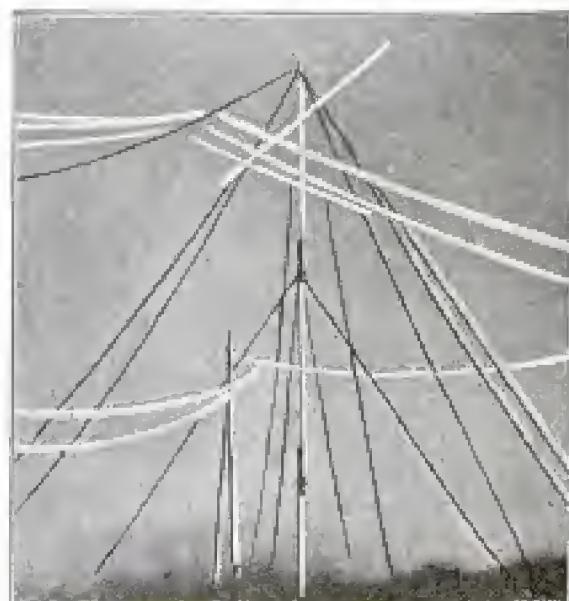
set to work with shovels to dig the captive out. To do this it was necessary to lay boards around the swampy bed of the creek on which to stand. After digging half way to the captive, with



Courtesy of Sather, Hall & Co., Honolulu

Buoys for Cable Repair Ship's Kit

the mire oozing back almost as fast as they could throw it aside, 50 men formed a human chain and pulled him out. As they worked the captive gradually sank deeper and deeper until his nose and mouth were beneath the surface when they reached him.



Although the electric waves which transmit wireless messages are invisible to the naked eye this wonderful photograph is believed to be an actual reproduction of a Marconi message leaving the wires on its journey across the Atlantic ocean. The plate was exposed at night while experiments were in progress.



Curious freak photograph taken by a Portland, Me., artist at Sebago Lake, Maine.—Courtesy the Motor Boat.

BRIDGES FIRST; THEN CANAL ECONOMY IN FUEL ON OCEAN EXCAVATION LINERS

A novelty in engineering construction will be a feature of the digging of the Evanston channel of the Chicago drainage canal system. The bridges which will span the canal will be made of concrete and placed in position on heavy concrete foundations ready to use before the ground is excavated. Engineers have informed the drainage board that the erection of the bridges before the trench is dug will prove not only possible but more economical than otherwise.

LOADING RAILROAD CARS WITH SAND

This structure was built to simplify the loading of railroad cars with sand. To get an easy grade for the teams the approach was made 80 ft. long. Brakes on the wagons made it possible to construct the down incline much shorter. A trap door in the floor allows the sand to fall through.

The break in the Pacific cable has been found and repaired.

Wonderful advances have been made in marine engines during the past few years, not only in construction, but in economy of fuel as well. An 8,000-ton ship built for the Hamburg-American line in 1890 burns nearly twice as much coal as a 17,000-ton ship built for them in 1906. The White Star liner "Baltic," 24,000 tons, burns less fuel than the 7,000-ton "Bretagne," built in 1886. At the beginning of ocean steam navigation it took 550 tons of coal to drive a 2,000-ton vessel across the Atlantic at a speed of 9 miles an hour. Today a 20,000-ton vessel can be driven across at a speed of 23 miles an hour on a



Sand Falls Through Trap Door Into Car

consumption of only 3,000 tons of coal.

Work has commenced on the Cape Cod canal.

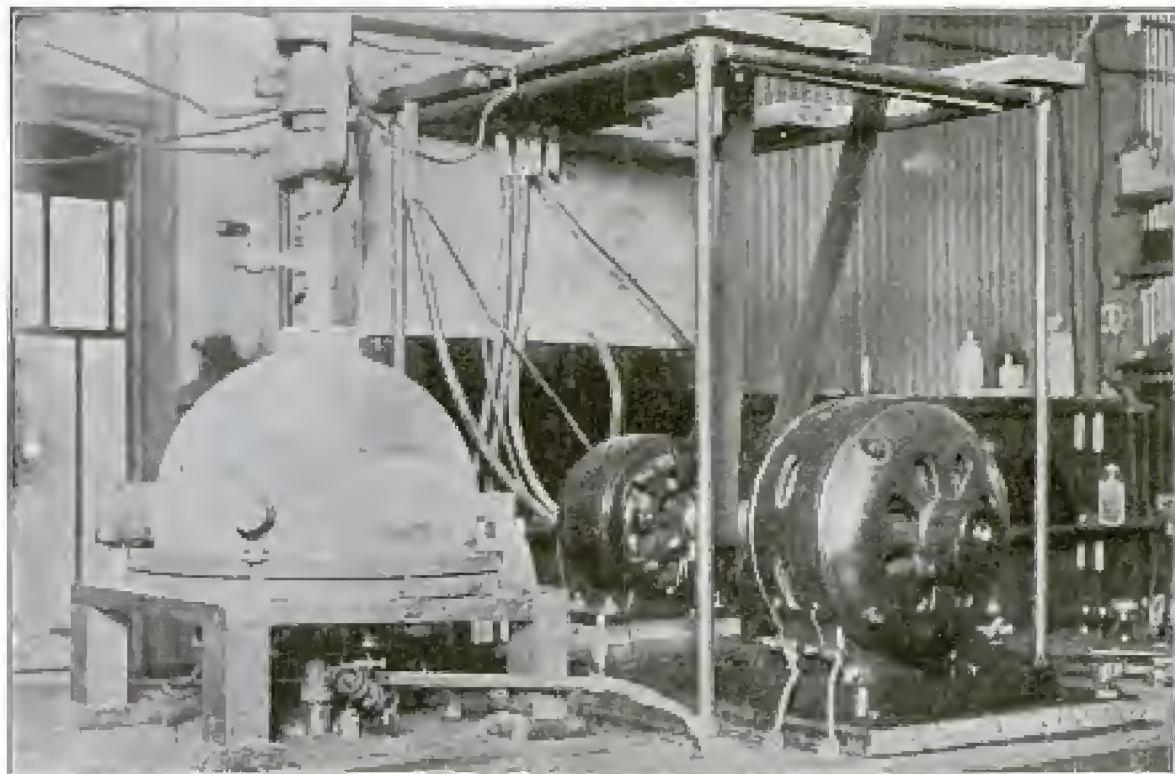
FOOD FROM THE AIR

Chemical-Mechanical Process Which Scientists Have Sought for Years Apparently a Great Success

By Carl Shelley Miner, Consulting Chemist for Popular Mechanics

The first great step in the series of experiments that will eventually result in the substitution of the processes of the laboratory for the processes of life in producing food, is an accomplished fact. Quietly, almost without our realizing what has happened, this thing has come to pass. We can actually make food out of air. Not a food for man,

often fifty million of them exist in a single ounce of soil have the power of "fixing" the nitrogen of the air or, putting it more clearly, they are capable of making the nitrogen of the air into a food for plants. The plants then take the nitrogen as it has been prepared for them by the bacteria and make of it a food for animals by their



Courtesy of William Thomas, inventor of the process.

Apparatus Which Extracts Nitric Acid from Air

only a food for plants, but made directly from the air around us by a chemical-mechanical process.

Nitrogen is the most important element in our food, and though it comprises four-fifths of the air, it must go through a series of intricate processes before it can be of any value as a food for man. As it exists in the air it can not be used even by plants, but certain species of bacteria so small that

own processes; but plants, with exception of the legumes such as beans and peas, are not concentrated nitrogen foods, and it remains for the animals, by eating the nitrogenous compounds of the plants, to make of them a highly concentrated nitrogenous food, meat, which despite the struggles of the vegetarians still remains the great staple of human diet.

It is this series of processes that the

chemist must imitate in the laboratory before he can hope to produce food-stuffs without the assistance of plants or animals and already he has succeeded in doing the work of the nitrogen fixing bacteria, for he now makes a nitrogenous plant food from the air without their help.

A few years ago Sir William Crookes, one of the most noted of living scientists, called public attention to the fact that if some new method of furnishing nitrogenous food for plants were not discovered in less than 50 years a tremendous famine would sweep the race of men from the earth. It had long been known that the bacteria were not able to furnish nitrogen for the plants as rapidly as it was needed for our enormous crops and for years they had been helped out by the use of fertilizers, materials containing nitrogen



30,000-Volt "Fixation" Flame

in more or less concentrated form, chief of them being Chile saltpetre or sodium nitrate. It was the certainty of the eventual exhaustion of the beds of this material that brought out Sir William Crookes' warning. Since then only a few years have passed, but chemists everywhere have been investigating this problem and several satisfactory solutions have been offered, two of which are already being operated profitably. All the processes combine the nitrogen of the air, where it exists in absolutely unlimited quantities, with some other element in such form as to make it available for fertilizer.

In Italy and Germany, an invention of Professor Adolph Frank is being used to produce an excellent fertilizer called calcium cyanamide. This compound is produced by passing nitrogen

gas considerably purer than that of the air over heated calcium carbide, with which it combines to form a readily available fertilizer material. Several foreign and American processes make use of the well-known fact that when a mixture of nitrogen and oxygen such as air is brought into contact with the flaming electric arc, a chemical combination of the two gases called nitrous oxide is formed, which may readily be combined with minerals such as calcium or sodium to form excellent fertilizers. By one method used at Niagara for a time, a shaft carrying a large number of points electrically charged, revolved inside a cylinder carrying an equal number of points electrically charged, and thus by continually making and breaking a very large number of connections a great number of flaming arcs were formed and by passing air through the cylinder nitrous oxide was produced. This process, however, did not prove to be a commercial success and the company has now abandoned operations.

The Norwegian company has been more successful. They use the Birkeland-Eyde process. In this process a flaming electric arc is drawn out by means of a magnet into a fan shape and the air is driven through this intensely hot arc. By this means a considerable quantity of the nitrogen and oxygen are brought into combination as nitrous oxide and by a simple subsequent process it is combined with lime to make calcium nitrate. This process has been operated successfully for some time and will undoubtedly be of great value wherever exceedingly cheap power is available, as it is at Notodden, Norway, where the present plant is in operation. That it can be made universally available is still doubtful.

The aim of the Chicago investigators, who have been working for many years, has been to perfect a process to make possible the utilization of the nitrogen of the air at a price that would make the operation of factories commercially profitable wherever power at ordinary prices is available. At present they are operating an experi-

mental plant in Chicago, where they claim to produce nitric acid at something like one-tenth of its present market price. They make use of the same principle which forms the basis of the Bradley-Lovejoy and Birkland-Eyde processes—namely, the action of the flaming arc on air—but their process is distinctly different from either of its predecessors. The main feature of their plan is the use of a closed chamber in which the gas is treated under pressure. In this way a more concentrated product is produced, and waste of power by heating large quantities of air is avoided. The second important feature is the flame, a peculiar elongated arc which is produced by using a pressure of 33,000 volts, but which is several thousand degrees colder than the Birkland-Eyde flame. In fact, the gases come from the chamber almost as cold as when they enter it, thus showing that the electrical energy has been used, not to heat the gases, but to actually combine them, which goes far to prove the superiority of this "fixation flame," as they call it, over the arcs formerly used. As the process is now operated in their plant it is briefly as follows:

The air is introduced into a small hemispherical chamber under pressure. The valves are closed and the arcs turned on for a period of about five seconds, during which there is a considerable rise in temperature and a consequent increase of pressure. The outlet valve is then opened and practically all the air is driven out by its own pressure. The outlet valve then closes automatically, the inlet valve opens at practically the same time, a new charge rushes into the chamber and the operation is repeated. The gases as they leave the chamber consist of a mixture of air, with a small amount of nitrous oxide which combines with oxygen and water to form nitric acid or with lime to form calcium nitrate. I have seen the plant in operation and there can be no question that the nitric acid is actually produced, and if the process works out as

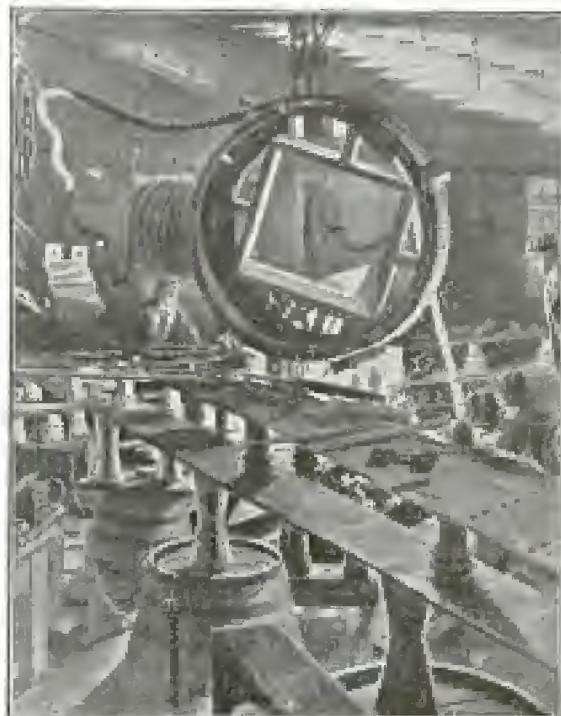
satisfactorily on a large scale as it has in this experimental plant, the fertilizer problem is solved and incidentally the fortune of the inventor is made.

With two commercially successful methods of utilizing the nitrogen of the air in operation and this latest one which bids fair to lower the cost of production still further, we may fairly consider this problem solved and the danger of a strike of the International Federation of Nitrogen Fixing Bacteria a thing of the past.

* * *

MARCONI WIRELESS TRANSMITTER

* * *



The Transmitter

This illustration shows while at work the Marconi transmitter which catches the spark that speaks across the Atlantic ocean. The plates which radiate from the huge coil in the center of the shed are connected with a great series of galvanized iron plates hung parallel to one another in an adjoining room. For a second or two before the message begins to arrive there is a sound like a deep growl of thunder, then the spark passes with a rending detonation. For the rest of the time taken to receive the message, the noise resembles that of a machine gun in action.

DIABOLO A CENTURY OLD

Diabolo, the fascinating game which, for the past few months, has been the

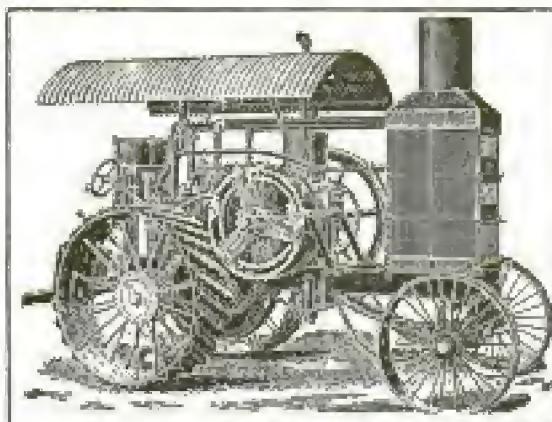


From an Old Print

rage in England and on the continent, has at last been whirled across the ocean to this country by the enthusiasm of the players. It is not a new game, however, as many suppose, but a return to one of the most popular pastimes of the French court during the earliest days of the Empire. It is said that the game was introduced just before the final fall of the Monarchy to keep the court so busy with "foolishness" that there would be no time for intrigue.

KEROSENE TRACTION ENGINE

The latest improvement in traction engines is the one driven by a gasoline-kerosene engine. It is air-cooled, which does away with the water jacket entirely, making the machine especially adapted to winter use or cold climates.



It is Air-Cooled

As no steam is made, there is an entire absence of sparks and smoke.

DON'TS IN ELECTRIC LIGHTING

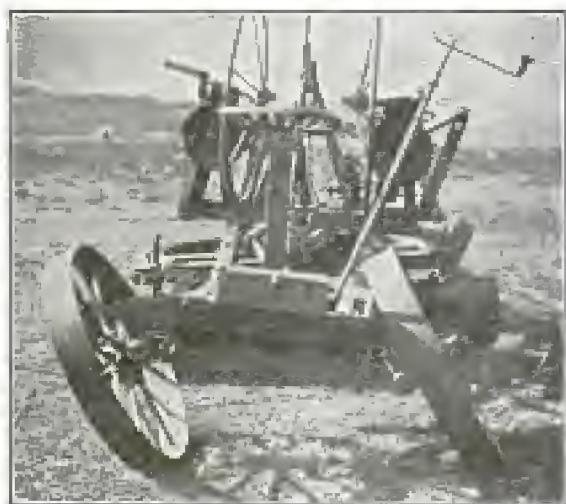
Don't let the office boy or any one else who does not understand make changes in electric wiring or lights. They may do the very thing they ought not.

Don't let a socket on a fixture hang loose. Have it repaired. Otherwise it may cause trouble where least expected.

Don't try to save a little by running flexible wires over boxes, partitions, and into closets. Have permanent wires installed. These flexible wires used this way are dangerous.

ROAD GRADER ON HINGED AXLES

This road grader leaves as clean a



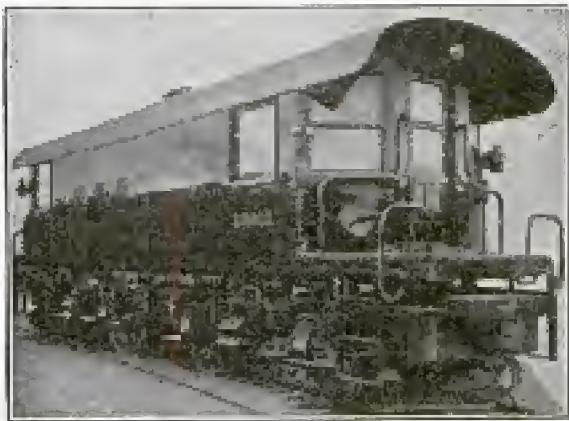
Works on Hillside

path behind it on a road that slants abruptly toward the curbing as on a road absolutely level. The scraper blade is set at an angle. This would put a severe strain on the spokes of the wheel and cause the rims to slip sideways on a slanting street if it were not that the axles are hinged, allowing the wheels to be tipped to suit the work required.

The average man can lift 225 lb.

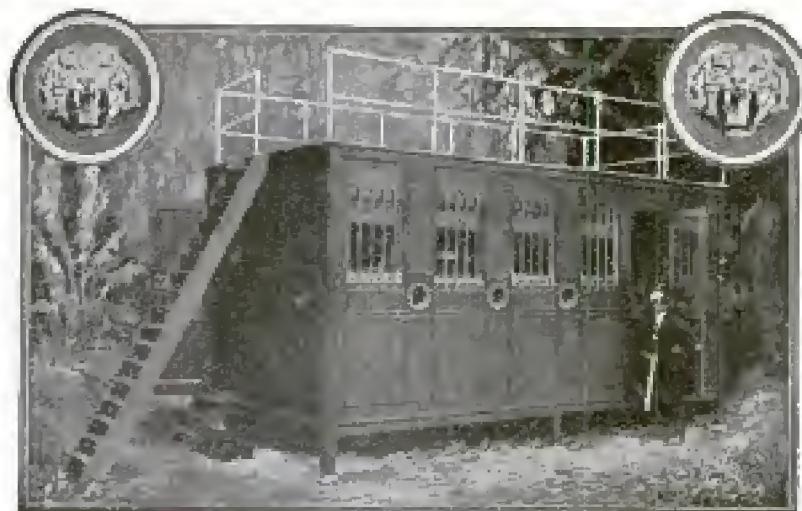
DIRECT CURRENT ELECTRIC LOCOMOTIVES

The Pennsylvania railroad is experimenting with the different types of



Electric Locomotive

electric locomotives for the purpose of determining which is the best adapted for pulling its heavy passenger trains through the New York tunnels. This illustration shows one of the direct current locomotives undergoing tests. It is equipped with four 350-hp. geared motors. The trucks are of the 4-wheel type. The driving wheels are 56 in. in



The Jam's Luxurious Shooting Box

diameter, fitted with removable tires.

Another engine, almost identically the same in exterior appearance, is equipped with four gearless motors.

White spots on table tops may be removed by applying a wet cloth pressed down for a few minutes with a hot flatiron.



WHITEST CRACKER IN THE WORLD

The rice flour cracker of China is by far the whitest biscuit product in the world. In comparison with it the whitest American biscuit looks dingy. This cracker, however, is altogether too sweet for most occidental palates and the Chinese much prefer their black cracker, which differs but little in taste from the American sweet biscuits.

SAFE WAYS OF HUNTING BIG GAME

Prince Ranjitsinhji, the Jam of Nawanagar, India, hunts big game and has had constructed for this purpose a wonderful movable shooting-box. The windows are heavily barred and port-holes are pierced every 3 ft. around the sides. The interior is decorated in Queen Anne style, and filled with sofas, writing desks, bridge whist tables and comfortable chairs. The floor is covered with Persian rugs. The exterior is painted green in order that it may blend with the jungle.

The box is taken to pieces, sent by rail to a given point, and drawn by oxen or elephants into the heart of the jungle. It is left there until the tigers have become accustomed to it, and when the royal sportsman arrives later there is no lack of game. The shooting is done through port-holes provided for the purpose.

THE AMPHIBIOUS AUTO

Navigates Land and Water Successfully—Climbs Hills and Banks



The Machine Repeatedly Entered the River and Climbed the Bank

"Waterland," the French auto which climbs river banks and hills, or dives into the river and swims, was given a demonstration in the Hudson river. It was brought over by its inventor, Jules Reveillier, and is the same type of machine exhibited in France a year ago and fully described in these pages at that time. It is a boat having four

solid wheels for travel on land, in addition to a propeller for use in water. The power is shifted from one to the other by means of a lever. The land speed is 20 miles an hour; the water speed 9 miles. The demonstration was a complete success, as seen in the illustrations, but the commercial value of the machine appears to be doubtful.



"Waterland" Attracted Attention When Traveling Along the Street

AN AMERICAN AEROPLANE

America is rapidly contracting the flying fever, and with the "hustle" which characterizes the American in business or pleasure, it will not be long before this country becomes a seriously considered rival to France.

The latest American aeroplane to spread its wings to the breeze in trial flight is the "Aeriator," a machine constructed by George A. Lawrence, Sayre, Pa. In its first trial the machine flew a distance of 200 ft. at a height of 40 ft. above the ground. The second trial was attended with about the same amount of success.

A larger aeroplane, of the same model, is being constructed with which the inventor hopes to compete at the next airship contest. The new machine will be capable of carrying three ordinary persons, and will measure 37 ft. from tip to tip of wings. Motive power will be generated by a 60-hp. engine capable of driving a 7-ft. wheel 900 revolutions a minute. A 9-hp. emergency engine will also be installed to drive a 3-ft. wheel at 1,500 revolutions a minute.

BOAT DRIVEN LIKE A FISH

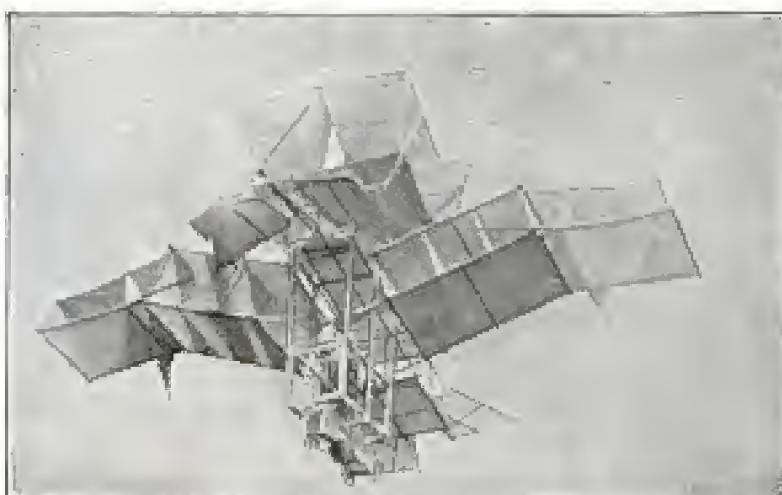
Predictions are made that before long the "vertibrate" propeller, a new invention shown privately to a party of naval engineers and yachtsmen in New York, will become a subject for serious consideration by engineers.

The piston rods of the four cylinders used to drive the propeller pass through the bottom of the boat and connect directly with a flexible steel plate, which, lying parallel with the hull, forms the propeller. The vertical movements of the piston rods impart to this plate a sinuous motion similar to the movement of a fish's tail. The

rods are supplied with suitable stuffing boxes where they pass through the bottom of the boat.

FLOATING HOSPITAL FOR NEEDY SICK

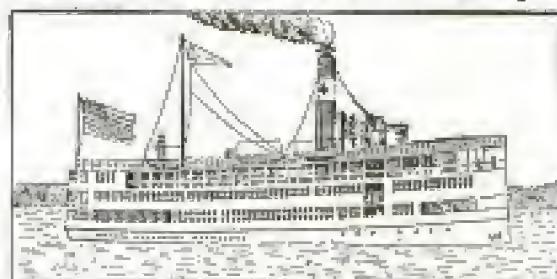
Ploughing her way through the water, carrying a load of suffering humanity on health-giving trips, Boston's



The Lawrence Aeriator

new floating hospital has become one of the sights of Boston harbor. The boat was built especially for this mission and every day carries the needy sick from the poorer sections of Boston into the clear, pure atmosphere.

The boat is twin screw, built of steel and has four decks, designated as the main, hospital, out patients' and hurricane decks. The length of the boat over all is 170 ft., beam 45 ft., depth



On Red Cross Duty

at side 10 ft. 8 in. The gross tonnage is 594. The hull is of steel, subdivided into seven water-tight compartments.

Asbestos shingles, made of asbestos fiber and cement, absorb about 5 per cent of their weight in water.

SPECIAL INDUSTRY EXPOSITIONS FAVORED BY GERMANY

The German Commercial Union some time ago sent circular letters to the German chamber of commerce to learn their views with reference to a world's exposition at Berlin in 1913. In answer the chamber of commerce at Mayence adopted the following resolution, which seems to voice the opinion generally entertained:

"We cannot recognize the holding of a world's exposition at Berlin as in the interests of Germany's industries, and believe it more advisable to organize for all products of human activity international expositions of a special industry, as only such can have the effect of fructifying and stimulating the industries and trades."

Concerning this resolution Kurnlow's German Trade Review says:

"The chamber is therefore of the opinion that from its district no substantial participation can be expected in a general world's exposition, but that such could be expected in special industry expositions, providing they do not succeed each other too quickly."

COST OF SPEED AT SEA

Many people do not realize the great price the owners of fast ocean liners pay for every mile of speed added to the average day's run. Statistics show that when an ocean liner exceeds a speed of 15 or 16 miles an hour, the expense of operation must be sought after outside the receipts for cargo—in government subsidies, perhaps.

The average ocean freighter rarely exceeds a speed of 12 miles an hour, and at this economical rate can profitably carry freight to any part of the world, providing she flies a foreign flag. American ships are at a disadvantage, because the operating expense—size and wage of crew, etc.—are so much greater.

The shipbuilding plants on the Clyde are now ready to build 1,000-ft. ships and before long the length will be reached, but it is not likely that a greater speed than at present will be attained until some revolutionary change in propulsion is made which will materially cut down the cost of operation. With this in view great

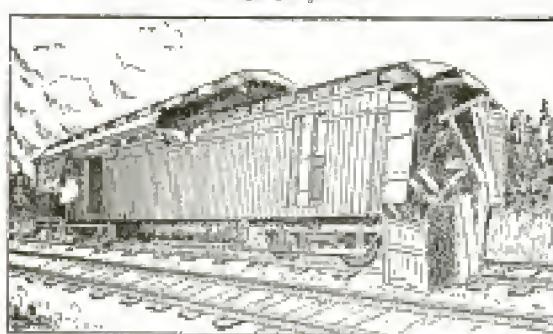
marine engineers all over the civilized world are experimenting to find the means for more speed at less cost.

ODD ENGINES TO SUPPLANT MULES

Within the next few weeks there will be in operation between the railroad and great borax mines in Death Valley, Southern California, a cable locomotive that will do away entirely with the famous "20-mule team," of which so much has been written and so many pictures published.

The unique feature of the new enterprise is the method of applying the power. In the center of a railless road 10 miles long will be laid a strong steel wire cable, 1½ in. in diameter. Instead of the cable drawing the 4-ton locomotive, it remains stationary and the locomotive, clutching hold of it, draws itself along. Beneath the locomotive are two sprocket wheels upon which runs an endless chain made up of links, each one of which grips the cable in turn. Sixteen links take hold at once. The locomotive thus fairly pulls itself over the ground, and so great is its power that grades of 50 per cent can be traversed. The engine of the locomotive is similar to that of an automobile and can develop 200 hp.

The new method of hauling out borax to a point where the regular railroad connection may be reached is a great improvement over the present mulepower which has been used for so many years, and because of the death-dealing climatic condition of the valley it is the only feasible plan.

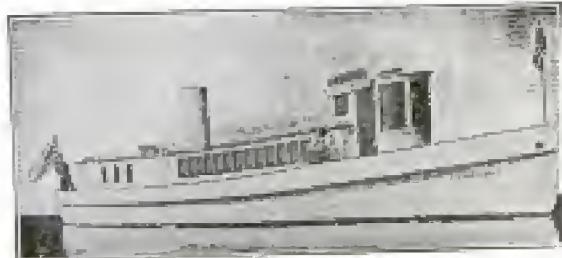


Car Telescoped in Wreck on C. M. & St. P. at Lenark, Ill.

DETROIT RIVER MAIL BOAT

The mail boat "C. F. Beilman Jr.," which has just been completed for service in connection with the United States Marine post office at Detroit, delivers mail to all the shipping of the great lakes as it passes through the Detroit river.

The boat has a maximum speed of 13 miles an hour and hovers in the center of the river day and night, ready as soon as a vessel approaches to glide swiftly alongside and by means of a basket or bag attached to a pole, receive and deliver mail to crews and passengers. When so many vessels are passing at once it is impossible for the mail boat to get to all of them, hence two auxiliary row-boats are always in readiness to row alongside the ships, make fast by throwing a light tow-line to the towering decks above, and pass up the mail in a bucket.

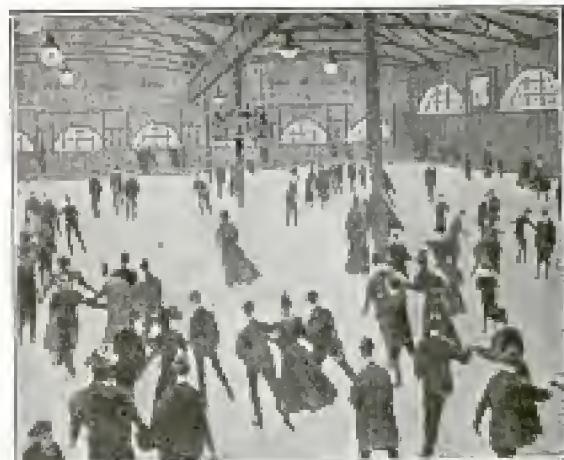


Great Lakes Post Office

The mail boat, constructed of steel throughout, is 75 ft. long, 14 ft. beam and 7 ft. in depth. The water-tube boiler is of 300 hp. at 250 lb. pressure. The engine is a 150-hp. compound making 450 r. p. m.

EUROPE'S LARGEST ICE SKATING RINK

The largest artificial ice-skating rink under cover in Europe has just been completed at Glasgow, Scotland, and thrown open to the lovers of the premier winter sport. The area of ice surface is 137,204 sq. ft. The actual weight of water frozen to produce this expanse of ice is 100 tons. The refrigeration system is driven by two gas engines, fed from a suction producer gas



Ice Surface of 137,204 Sq. Ft.

plant. Each engine is capable of giving 90 hp. The rink will be open each year from the first of October until the end of May. During the four summer months of the year the machinery will be applied to the manufacture of ice for refrigeration purposes.

MAHOGANY LOG OF GREAT VALUE

The forests of Honduras furnish to the United States every year great quantities of wonderfully figured mahogany of great value. This mahogany log, 16 ft. long and a little over 6 ft. through the center, only part of a gigantic tree, is valued at \$10,000. Some day in the future it will be found

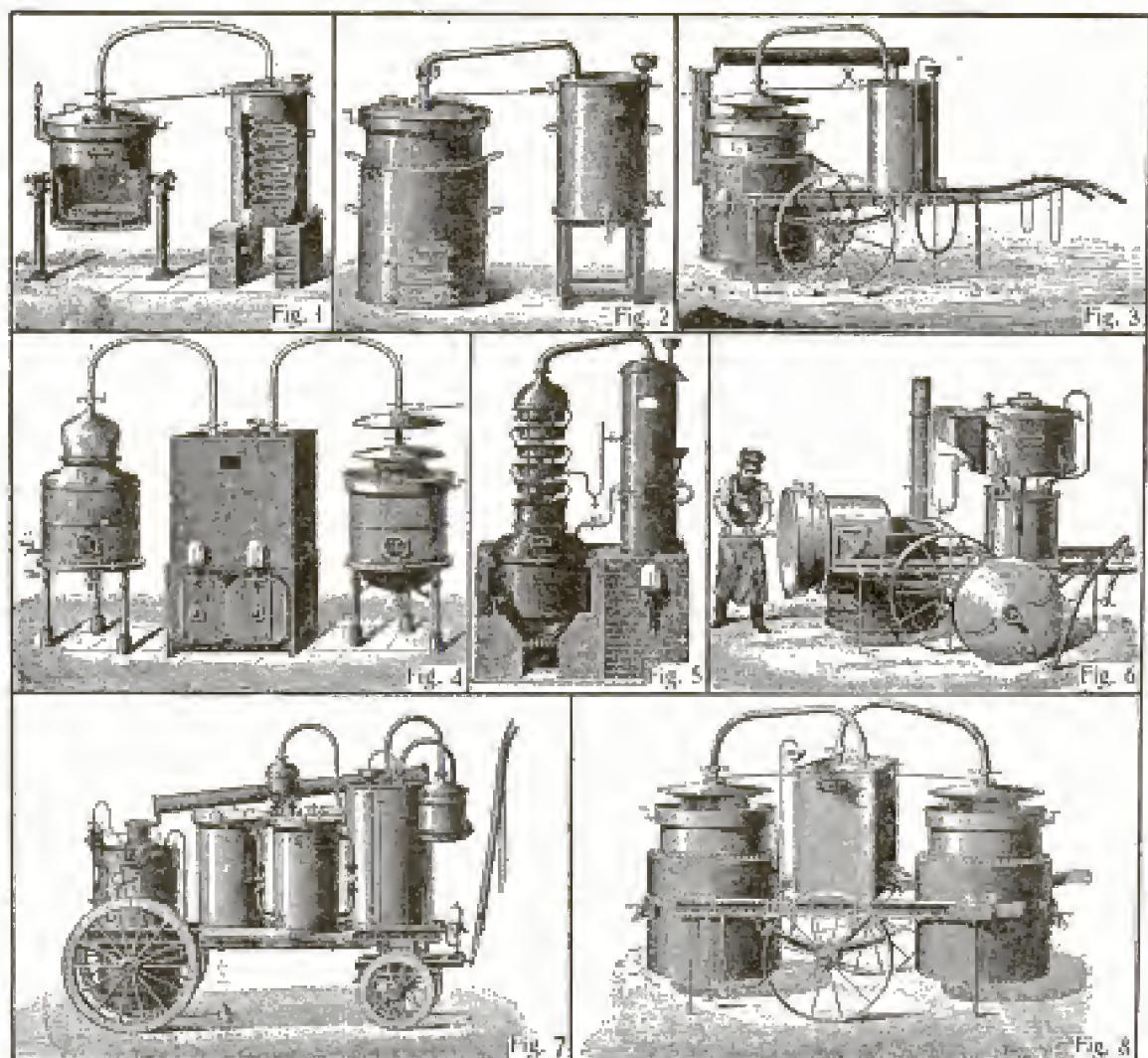


Section of \$10,000 Mahogany Tree

in artistically shaped and carved furniture, but will have nothing to identify it as part of this log,—except price.

Egypt's great dam at Assouan, built to harness the Nile, is to be raised 15 ft.

STILLS FOR MAKING FRENCH BRANDIES AND PERFUMES



A Few Common Types of French Stills

In the United States we are accustomed to associate the word "distillery" with a massive building from whose towering stacks belch clouds of smoke visible miles distant; the ownership and operation of the business being vested in some trust. France, on the contrary, has many thousand distilleries, ranging all the way from the simple affair of a small vineyard or rose farm, with a capacity of a few gallons or even ounces per day, up to the concerns whose establishments cover acres. Distilling outfits can be bought as low as \$20, with a capacity of only one quart of material to be distilled, and heated with a small alcohol lamp. Some out-

fits are built on two-wheel carts, which can be pushed from town to town by hand; others are drawn by one or more horses. So great an industry is the manufacture of stills that a single firm in Paris catalogs over 100 stills for the making of brandies, rum, cordials, perfumes, essential oils, etc., and has at the present time more than 4,000 of its stills in use in France alone.

Fig. 1 shows a sample type much in use, in this case heated by steam, and arranged to tilt for emptying the "copper" or container when heavy solids or thick liquids are being treated. The outer shell is shown cut away to reveal the interior construction. From the



Indian Elephants Towing Rafts and Rolling Logs

copper the steam rises and passes through a copper pipe to the still at the right, the worm or coil being immersed in water, which is frequently cooled to assist condensation. The steam condenses in the worm and the liquid resulting is drawn off at the bottom.

The still shown in Fig. 2 is the same as Fig. 1 except it is heated by a furnace burning any convenient fuel. In this case a double bottom and layer of water keeps the fire from direct contact with the contents of the copper. These stills are largely used in making brandies, which are produced in one operation, without restilling.

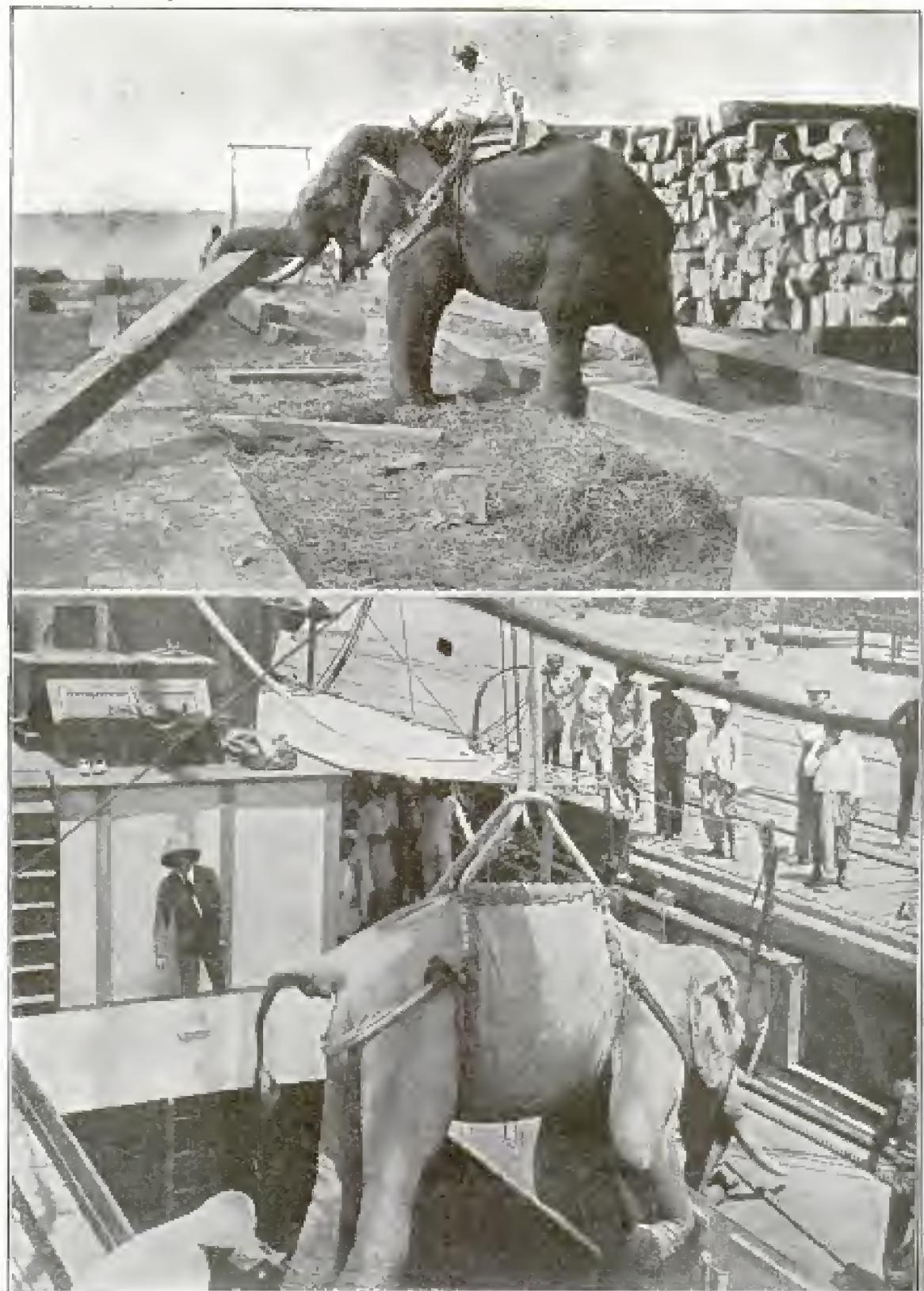
Figure 3 shows a still of the same capacity with furnace and hinged smoke-stack, mounted on wheels and intended to be drawn by one horse. The copper will contain about 50 gal. at each filling. These portable stills are often taken to the vineyards in grape pressing time, and after the juice has been pressed from the grapes the "grape cake" is put in the still and from it is produced tartar crystals and certain grades of brandies. These stills are much used in making high grade brandies from wine. The small straight pipe marked "X" in Fig. 3

has a control valve, by means of which the operator can regulate condensation of the alcoholic vapors and thus control the strength and quality of his product. Fig. 4 is an absinthe still, with two condensers in same cooler.

Perfumes are made by distilling the juices of flowers—which are first put through a chopper—by a process quite like that of making brandy. Instead of one solid mass, however, the flowers are spread in pans with distilled water running from one pan to the next, the pans being inclosed in an air-tight metal cylinder, which can be attached to the top of ordinary stills. The parts forming the rectifying column for a flower still are shown in Fig. 5. The stills shown in Figs. 6, 7 and 8 are types of portable steam stills. We are indebted to Deroy, Paris, for the illustrations used in this article, which deals with only the simplest and smallest types of stills. The larger machines are complicated affairs, difficult to describe or understand, although working on the same general principle.

To remove oil spots on marble apply a paste made of 1 oz. potash and $\frac{1}{2}$ lb. whiting. Leave on for five hours.

POPULAR MECHANICS
WHERE ELEPHANTS DO REAL WORK



The above pictures are unusually fine illustrations of the Indian elephant who does real work, hard work, and lots of it. A trained working elephant is a valuable piece of property. On the preceding page they are seen towing rafts, and rolling the heavy logs up on high land. In lifting, carrying and piling heavy railroad timbers they take the load on their tusks and hold it there with their trunk. It is frequently necessary to transport a herd of workers, and this is usually done by ship. The process of loading and unloading these big beasts from the ship's hold is one more enjoyed by the spectators than the elephant, who is placed in a strong canvas sling and hoisted with a steam derrick.

TREE DENTISTRY

Many methods are being tried for the preservation of old and historical trees in the east, some of which are intensely interesting. On the estate of



Pear Tree—Cement Filling

John J. Little, at Bala, Pa., is a very old sycamore, the trunk of which had become decayed. The cavity was filled with stone and cement and around its base was then built an outer stone wall, so arranged that the water would drain away from the trunk of the tree.



Filled with Stone and Cement

"COMPRESSOL" SYSTEM OF FOUNDATIONS

The French "compressol" method of foundation construction has opened up a new and interesting field in modern foundation building. The method is simple. A conical ram, having a diameter of 3 ft. at its base, and weighing 3 tons, is employed to make the excavation. The action of the ram, which is worked the same way as a pile driver, bores a hole down to a solid foundation. After reaching a compact bed of gravel or stone, loads of cement and broken stone are rammed down in separate layers, forming a foundation pile or block of high resistance.

These piles have the shape of an inverted mushroom stalk, the base widening out to a diameter of 4 or 5 ft., according to the soil density.

This system does away with the necessity of excavation with the usual shoring up, ventilation and pumping required. It is claimed that a foundation pile of this character cannot collapse when carrying heavy loads and that one



of such will take the place of six piles of any other construction.

CONCRETE MIXER BUCKET

The cube or circular concrete mixer shown in this illustration is fed by a



new bucket attachment which is raised by power after the ingredients are measured in, thus saving shoveling.

TIMBER FOR MINES EXPENSIVE

Last Only 2 Years—150,000 Acres of Forest Depleted Annually

It is estimated by the government that the cost of anthracite coal is increased 8 cents per ton by the expense

of mine timbers used for cross ties, tramways and supports. To supply this timber requires each year the product of 150,000 acres of forests.

As the average life of timber in a mine is approximately only two years it is of great importance to know what method of treatment will preserve best at the least expense. For this reason the government has conducted experiments which prove that peeled timbers, saturated in a solution of creosote, have almost twice the life of unpeeled timber. This method costs about \$2.85 cents per set of mine timbers.

STONE LIGHTER OF STEEL

The stone lighter shown in this illustration is built of steel and is 200 ft. long, 37 ft. beam and 13 ft. deep, having a capacity of 2,000 tons. The stone is all carried on the deck and to support this, five fore and aft trusses have been constructed, giving both the deck and hull great rigidity and strength.

At each end is a derrick rising 56 ft. above the deck, the legs of which are built of heavy channels of steel latticed together. The boom is 85 ft. long and can pick up a load 65 ft. from the edge of the dock. Each derrick has a safe load of 10 tons. The only wood in the boat is the 2-in. planking laid on the deck to take the surface wear.



Douglas M. McLean Co.

New Type of Construction for Stone Barge

BIG BALLOON'S LONG FLIGHT

Sails 500 Miles in Less Than 9 Hours in Charge of Oldest Active Aeronaut in the World



500 Miles in 9 Hours—Prof. King, Veteran Aeronaut, at the Left

Barred from the great international balloon race for the James Gordon-Bennett cup, which started from St. Louis Oct. 21, 1907, the Philadelphia owners of the "Ben Franklin," the largest gas bag airship ever built in America, having a capacity of 100,000 cu. ft. of gas, decided to have a contest of their own, which resulted in several remarkable experiences.

Piloted by the oldest aeronaut in the country, Professor Samuel A. King, 83 years old, who has made 451 ascensions without a mishap, and carrying in addition six persons, probably the greatest number who ever traveled any distance in a single balloon, the "Franklin" started from Philadelphia late one afternoon and alighted 30 miles to the eastward near Aura, New Jersey. There the balloon was tied to a tree and the aeronauts took supper with the farmer whose unexpected guests they were.

Although the statoscope, the instrument which shows at what height the

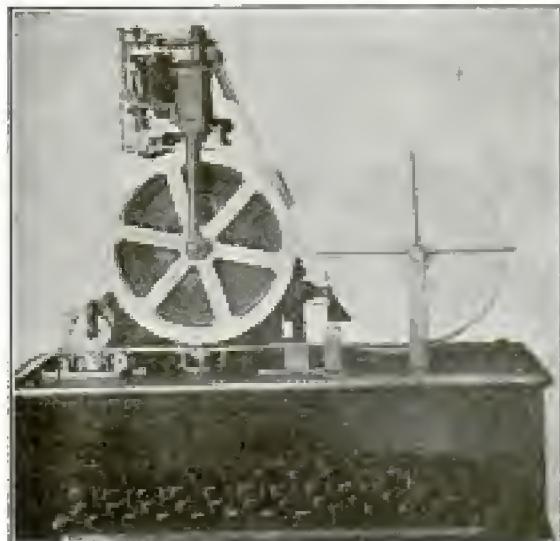
balloon is sailing, would not work, all but two of the party decided to risk another flight. The first breeze encountered carried them back almost to their first starting point, but striking a northerly current, they started on a new course. All night the aeronauts sailed, crossing five states and finally alighting at Dwight, a small town near Amherst, Mass.

TO CROSS OCEAN IN BALLOON

The Danish aeronaut, Ludwig Johansen, who has made more than 500 balloon ascensions, has come to America in hopes of interesting the editor of some American newspaper in a projected flight across the Atlantic in his new dirigible balloon. He proposes to attempt the trip from France to the United States, with two companions selected by the editor, if he finds it possible to get some newspaper to furnish the funds.

TYPEWRITER TELEGRAPH INSTRUMENT

A Californian has invented a typewriter telegraph instrument, designed to take the place of the ordinary Morse instrument, on which messages can be received and sent by any person who knows the English alphabet. Only a little larger than an ordinary typewriter, provided with a keyboard quite similar, and operated in identically the same way, the machine is expected to print letters, numerals and punctuation marks in plain English. The depression of any key on the board causes a wheel to revolve and at the same instant the corresponding letter or figure



Typewriter-Telegraph

on the key is printed automatically at the receiving station without the necessity of a receiving operator. The same instrument is used for both sending and receiving.

On the outer rim of a revolving wheel of aluminum are placed all the letters of the alphabet, the numerals and the punctuation marks. This wheel is controlled by three sets of magnets. The first regulates the starting and stopping of the wheel, the second brings the characters on the wheel in contact with the paper at the proper time, and the third operates a clutch which causes the letter-carrying rim to revolve. To begin operating, the starting key is released, which causes the re-

ceiving wheel to revolve once, setting itself at zero. At this point the letter-carrying wheel stops, but the internal apparatus, which carries the magnets, continues to revolve. The character on the keyboard is then depressed and instantly a current of electricity passes over the wire. The clutch magnets of the receiving instrument grasp the letter wheel and revolve it to the proper point. The working of the instrument is instantaneous and the speed of a fast typewriter operator can be maintained.

By strengthening the electric waves so that they will actuate a magnet it is claimed that experiments have proved the instrument adaptable for wireless telegraphy. It is likewise claimed that in sending press dispatches the receiving instrument can be attached to a linotype and the words set into type by the same manipulation which flashes them over the wires.

In many respects the machine is not new. In the United States patent office are records which show that over 400 patents have been issued to cover similar machines. Many of these have proved successful under ideal conditions, but none has as yet succeeded in displacing the Morse instrument. Only four of these machines have been thus far completed.

— • —
A motor boat of the hydroplane type made a speed of 34 miles an hour recently on the Seine in Paris.



The ore train shown in this illustration was thrown into the Cuyahoga River by the collapse of the Erie railroad bridge No. 5. The train collided with a locomotive on the bridge and the span gave way.

"MAURETANIA" WINS ONE-DAY RECORD

Buffeted—as much as a ship of her immense size can be buffeted—by one



Remarkable Photograph of Huge Wave Sweeping over Forward Deck

of the fiercest storms of the season, and then held motionless for hours in a dense fog, the "Mauretania," sister ship of the "Lusitania," made her maiden voyage, and although far behind the record run of the "Lusitania" from land to land, won the coveted right to fly one blue ribbon at its peak. On Thursday, November 21, the ship was driven 624 knots (671 land miles), or 7 miles faster than the fastest day's run ever made.

INEXPENSIVE FIRE ALARM SYSTEM

An inexpensive fire alarm device has been invented, which, attached to any telephone wire, will instantly and automatically give notice of the presence of fire. The contrivance consists of a box containing two magnets. When the temperature surrounding the box reaches

170° the circuit is closed and fire headquarters and central immediately warned. Should the subscriber detect the fire first, a button on the box can be pressed and the same result achieved.

For small towns and cities having no fire alarm system, the telephone company could furnish such a system by placing the boxes on street corners and in public buildings, at one-tenth the cost of the usual fire alarm system. For public alarm boxes the automatic contrivance is dispensed with.

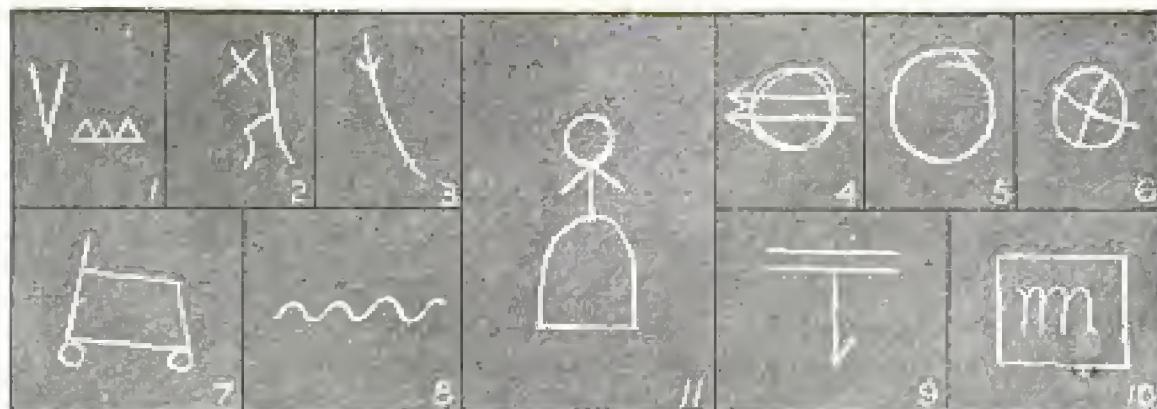
LOCATE ORE VEINS BY WIRELESS ELECTRIC WAVES

One of the latest ore-prospecting devices placed before the public is an electrical instrument, which, according to its inventor, will locate free metals at almost any depth, map out the course and width of the vein and ascertain its exact position below the surface.

The metal box to the right of the illustration contains apparatus for projecting in a straight line a powerful flux, or, more clearly, a field of inductive electricity, somewhat similar to the wave flux employed in ordinary wireless telegraphy. It is claimed that this flux will penetrate through any but metallic substances. When the flux strikes upon a vein of free metal ore the wave is impeded and a humming



Electric Ore Finder



A strange sign language by which tramps help tramps on their weary way: Fig. 1—Three women in the house. Fig. 2—No food without work. Fig. 3—Public official lives in house. Fig. 4—Be off as quick as possible. Fig. 5—Nothing doing. Fig. 6—Food given here. Fig. 7—Travelling money will be given. Fig. 8—Poor people; arrange tactics accordingly. Fig. 9—Allowed to spend night in hayloft. Fig. 10—Dog in garden. Fig. 11—Stop! the wife is at home.

noise in the telephone receiver attachment announces the find. By passing the small case over the surface of the ground the extent of the ore body can be ascertained, the indication of the presence of ore ceasing when the edge of the vein is reached.

GERMAN BRIDGE CONSTRUCTION

The steel staging shown to the right of the accompanying illustration somewhat resembles the steel frame-work of a modern skyscraper, and is being used in the construction of a bridge of the cantilever type across the Rhine at Ruhrtort-Homburg, Germany. The staging moves forward on a track as the work progresses. The three central

canalilever spans measure 390 ft., 660 ft. and 415 ft. respectively from left to right.

AUTOS SPREAD DISEASE

According to a report made by the American public health congress, the introduction of automobiles has tremendously increased the death problem—not the accidental death problem, the result of reckless driving—but the death problem which has for its cause disease germs carried in the dust. The improvement of public highways by laying the dust with tar, oil or other preparations, was recommended as the most necessary step toward the elimination of this danger.



Highway Bridge over Rhine, near Ruhrtort-Homburg

NITRO-GLYCERINE LETS GO

Following the recent explosion of a nitro-glycerine magazine near Petrolia, Ont., hundreds of people awakened from sleep went out to search for the scene of the accident, and in the darkness passed the spot where the magazine had stood, unable to locate the place because of the general change that had occurred in the landscape.



The Building Site Was Saved

At last one party of searchers stumbled over a small pile of broken bricks and fell into a formerly unknown hole in the ground. This was the place where the magazine had stood. The torpedo-factory buildings 250 ft. away were completely razed, and many plate glass windows broken in the business district of Petrolia, three miles away.

HOT WATER TANK HITCHING POST

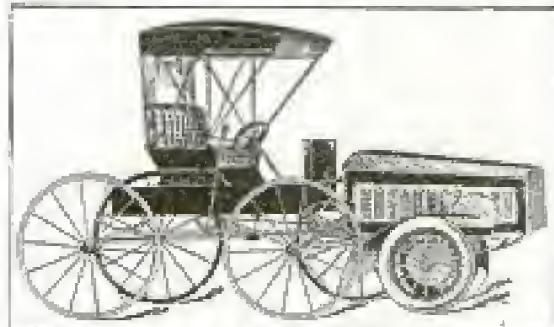
Many uses have been found for old kitchen hot water tanks, but it remained for a western blacksmith to use one for a hitching post. It cost no more than its worth as scrap iron and is easily located in the dark. When filled with sand it becomes very heavy and a horse cannot pull it over by jerking on the hitching strap.



Filled With Sand

SIX-WHEEL RUNABOUT

A recent idea in self-propelled vehicles is the 6-wheel runabout. The motor outfit is mounted on two wheels where the weight is evenly balanced,



Six-Wheel Motor

and the forward section attached to an ordinary buggy. Both sets of forward wheels respond to the steering wheel.

WALKING ON THE WATER

The lovers of the "freak" in water craft are manifesting considerable interest in the experiments of a French inventor who has constructed a pair of water shoes on which he walks on a smooth water surface with apparently as much ease as the spectators who follow his movements along the shore.

His water-boots are light shells, about 7 ft. long, and turned up at the ends. They greatly resemble the ski, a type of long, narrow snow shoe used in Norway, and are not more uncomfortable to use.



M. Redmond Walking on Water

FINEST COLLIER AFLOAT

The new steel collier, "Everett", built for carrying coal on the Atlantic coast between Boston and southern

MARINE DEATH RATE LOW

England's marine statistics for the year 1906 show that of the 955 masters and seamen who sailed their last voy-



New Type of Steel Collier

ports, has no equal in her class. The special feature in her construction is the self-trimming system by which she can keep on an even keel. Equipped with exceptionally powerful pumps, all water ballast can be discharged in six hours. The hold of the vessel is divided into five cargo-carrying compartments. The ship is 400 ft. long, 53 ft. in extreme width, and has a depth of 32 ft.

The officers' and engineers' quarters are as expensively fitted out as on many passenger liners, having baths, electric lights, steam heat and telephones.

age in this world during that time, 443 of them met death on land, either by accident or illness. This rate is the lowest in 16 years, being only 1 in every 557.

GROUND LEVELER

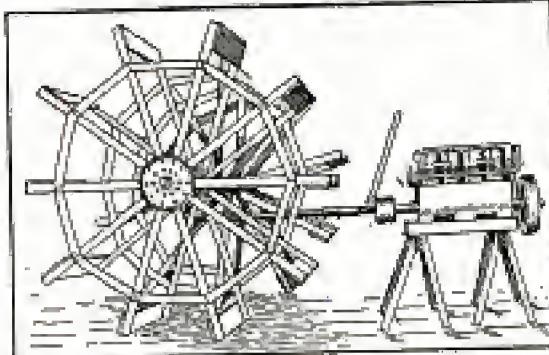
A combination scraper, harrow and roller outfit is proving effective in leveling ground for building and other purposes. If the ground is too hard and bumpy for the scraping blade the harrow teeth are dropped. The roller leaves the surface perfectly level.



Road Machine—Scraper, Harrows and Rolls

STERN OR SIDE-WHEEL PROPELLER

In all parts of the world there are countless lakes and streams so shallow or so thickly grown with weeds as to make screw propellers useless. The paddle-wheel in this illustration was especially constructed for motor boats contending with such conditions.



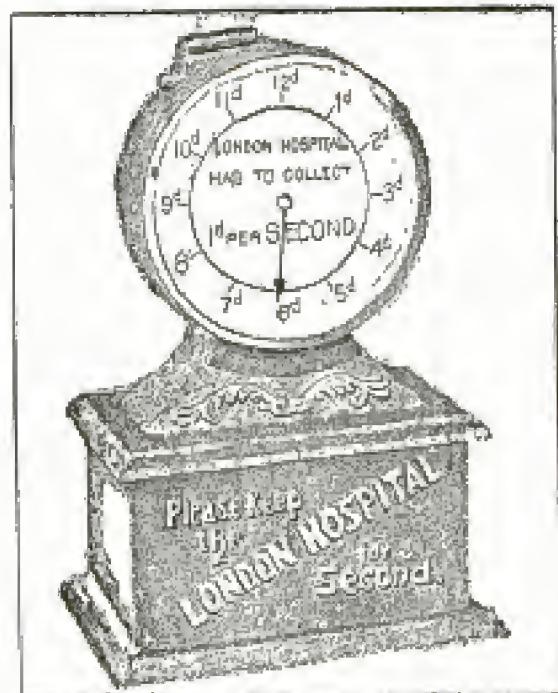
Stern Wheel Arrangement

This wheel is really two wheels, with the buckets or paddles set so they will strike the water alternately, giving a much smoother motion to the boat than if the wheel were in one section and the buckets striking the water in unison. The wheel, 7 ft. in diameter, is driven by a worm gear which gives it a ratio of one turn in 17 revolutions of the engine. By using a longer shaft the wheel can be pushed further apart, and straddling the boat become a side-wheel arrangement.

DEVICE GETS PENNY CONTRIBUTIONS

As is seen by this illustration, which is a novel device for obtaining small contributions, it costs 1 cent per second to run a large London hospital. Unlike the hospitals in this country, the London hospitals are entirely supported by voluntary contributions, and were it not for the donations of private persons and the general public, whose pennies even are solicited, these institutions would have to close up.

The London hospitals are regarded as strictly charitable institutions and it is for this reason that they can boast among their attending physicians even



English Charity Clock

the King's own physicians and some of the greatest medical and surgical practitioners in the world.

AUTOMOBILE AS WRECKER

One 30-hp. automobile proved of more assistance than a large squad of workmen in tearing down the columns on the court of honor which had been erected for the Elks' reunion in Philadelphia. A manufacturer of automobiles, while passing in his car, noticed the trouble the workmen were having and immediately volunteered to help. Ropes were attached to the columns and the car, and the former were soon reduced to ruins.



Auto Makes Quick Work

SINGLE WHEEL ROLLER SKATES

A one-wheeled roller skate, with cushion tires, of the extraordinary design shown in the illustration, has been invented by a Swiss engineer, who



Roller Wheels Beat Skates

claims that the one wheel enables the skater to execute turns impossible on other skates. He intends to increase the value of his invention by driving the skates by motor power derived from alcohol.

The department employees at Washington have decided to use roller skates in going to and from their work, the

superior condition of the streets of the capital city making the plan a practical one.

IMPROVED LARD BARRELS

An improved metal lard barrel is now being used by many shippers. Formerly lard was shipped in tapering firkins and the empties nested together, or placed one in another for return shipment. In this way the dirt on the bottom of one firkin was transferred to the otherwise comparatively clean interiors of others. In the metal barrel or cask shown in this illustration the clamps for fastening the cover down are eccentrics,—that is, they swing on an off-center pivot.



RHINE STEAMERS

The paddle steamers on the Rhine are unique and interesting and different in design and construction from most of the other river boats in Europe or America. The accompanying illustration shows the "Hugo Stinnes," which has two stacks and a large observation deck. During the past year seven sister boats were built, their dimensions being: Length, 240 ft.; beam, 26 ft.; draft, 3½ ft.



Popular Day Boat on the Rhine

HOW CHARCOAL IS MADE AND ITS USES



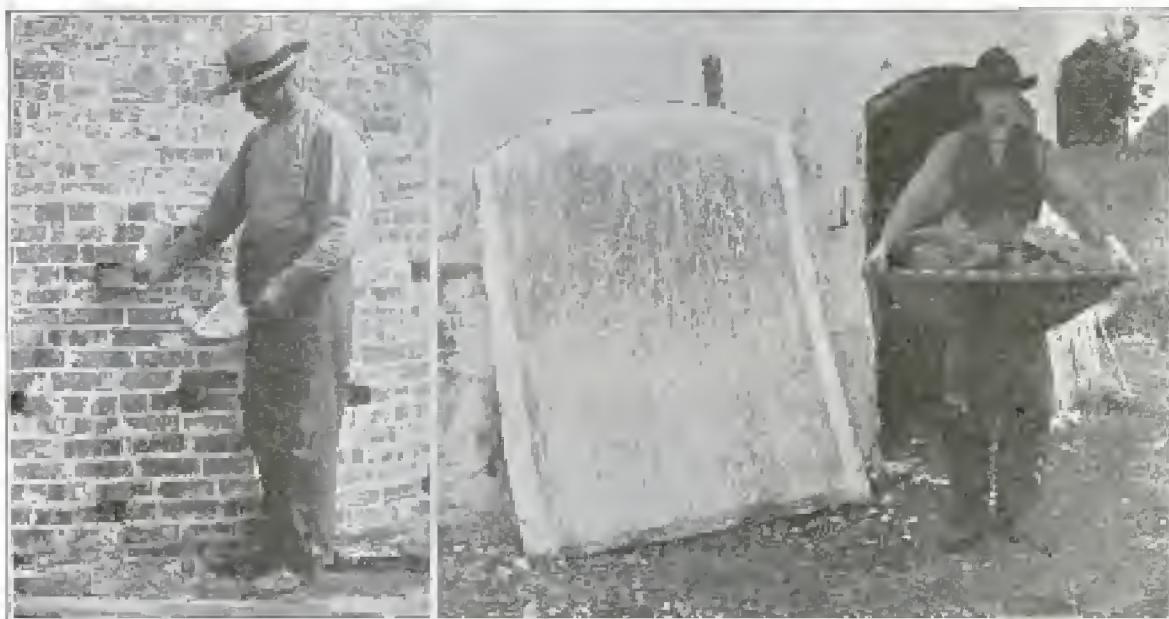
A Group of Charcoal Kilns

Despite the rapid decline of forests the charcoal industry in the United States has developed wonderfully during the past few years. Only a short time ago it was chiefly confined to the lumber regions of Michigan and the lumber belt of the Northwest. Today charcoal kilns can be found along railroad lines in some of the most thickly populated central states.

Originally valued only as an intense heat producer, its uses have steadily grown in number, causing a consequent growth in the importance of the industry. It is an ingredient in the manufacture of gun powder; a decolorizer of solutions; a medicine for dyspeptics and a purifier of water. As an antiseptic and cleanser its power is

universally recognized. In a hospital a piece of charcoal will soon absorb and decompose obnoxious gases and sweeten the atmosphere. All these are but a part of its uses.

Charcoal is wood burned in a kiln with only a limited amount of air. The limiting of the supply of air while burning is in progress keeps the wood from being reduced to ashes. In its production the volatile matter,—or the part of the wood subject to evaporation, is decomposed or burned by the fire, and the carbon remains. Before the present kiln came into use the crude method of covering the wood with earth and leaving air-holes at intervals in the mound—was resorted to by the charcoal burners.



Closing the Holes — Burning Ended — Door Removed

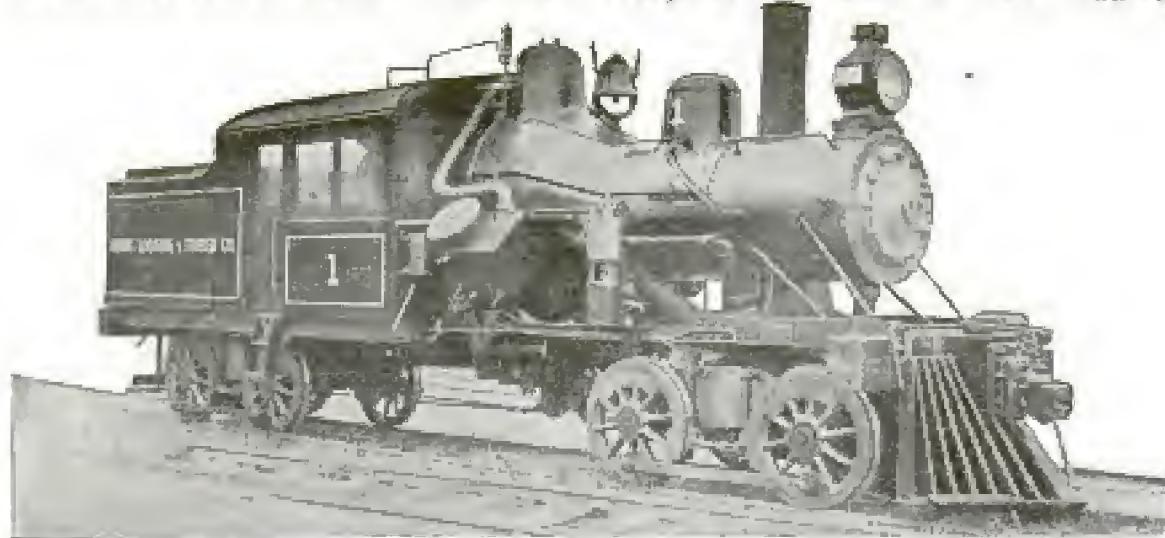
The charcoal kilns shown in these illustrations are operated day and night, requiring 200 cords of wood every 24 hours. The supply of wood is supplied a year in advance of the demand to insure its proper dryness. A plant of 10 kilns requires the almost continual labor of a gang of 40 woodsmen to keep it well fed.

A charcoal kiln is usually 22 ft. in diameter at the bottom, 20 ft. at the

but hemlock can be used for the manufacture of charcoal, although some kinds are better for certain purposes than others.

POWERFUL LOGGING LOCOMOTIVE

An interesting type of locomotive, equipped to burn oil, has just been completed for a lumber and logging



Logging Locomotive That Burns Oil

top and 9 ft. in height through the center. The wood is placed in the kiln in chunks about 4 ft. long. The metal door is then closed and the fire lighted at the dome. The air is admitted through small holes in the sides and dome of the kiln.

For four days the wood is allowed to burn slowly. The air holes are then closed with bricks and mortar until the kiln is airtight. With all air supply cut off, the fire dies out for lack of oxygen. The exact time for the closing of the holes and the smothering of the fire is determined by the color of the smoke as it comes from the openings.

The same time is required for the cooling of the kilns as for the burning of the wood. When cooled the metal door is opened and the charcoal carried out in specially designed metal baskets. The weight of a bushel of charcoal is usually from 16 to 20 lb., the exact weight depending upon the kind of wood used. Nearly every kind of wood

company near Seattle, Washington, and will be used for hauling heavy loads. The locomotive was designed to pull a train load of 2,500 tons on a level track at a maximum speed of 12 miles an hour. Its total weight is 104,000 lb., oil tank capacity, 1,700 gal., and working pressure 160 lb.

SPLICING A RAIL

About the only practical way to join an 80-lb. rail to a 60-lb. rail, is to bend the heavy rail at an angle and cut away a portion of the head or bulb. The outward bent portion is then dressed down about $1\frac{1}{4}$ in., so that the wheels will not touch the bent portion. The 60-lb. rail is also cut at an angle and rests securely on the lower flange of the heavy rail.

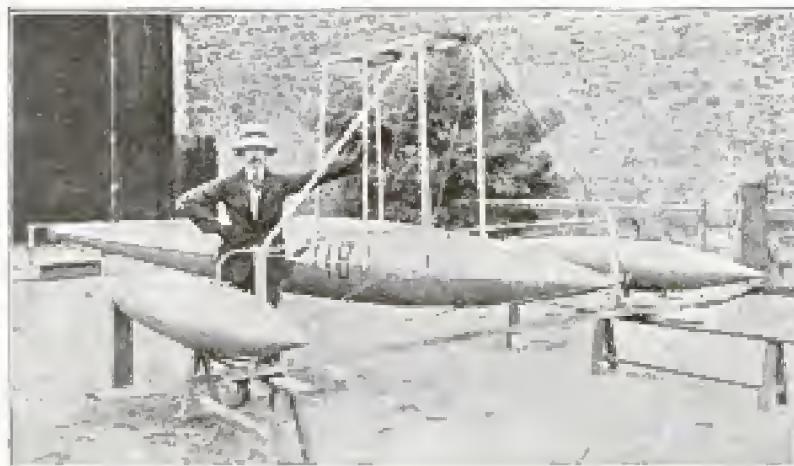


MUST TRAVEL 62 MILES AN HOUR IN WATER OR FORFEIT \$10,000

Santos-Dumont has completed the hydroplane with which he expects to attain the stupendous water speed of 62 miles an hour, and is about to make the trials which will win or lose for him his \$10,000 wager with Fernand Charron, well known in the automobile world. To win this wager does not only mean that his boat must attain a speed of 62 miles an hour, but that it must cover that distance in an hour, a proposition vastly different. His machine may tear through the water at the required speed for 50 minutes and then some accident occur to defeat him.

The hydroplane on which he relies to win the wager consists of three cigar-shaped floats, built of aluminum and wood, and covered with a silk waterproof envelope. The center tube is 32 ft. in length and the other two about one-third this size. The three tubes or floats are held together by a light metal cross frame. Above the center tube is

a raised skeleton platform on which the motor rests. At the rear is a transverse wood float attached to the tail of the middle tube. Above the float the



Santos-Dumont's Latest Invention

operator's seat has been placed. The rudder is placed just back of the float. Without motor and propeller the hydroplane weighs less than 200 lb. The motor weighs about 260 lb. and is capable of developing 120 hp. The cigar-shaped floats are filled with compressed air and in flight cut the water like a torpedo.

DIRT PUSHER SOLVES PROBLEM

Again the moment's necessity is the mother of invention. The contrivance in this illustration, which looks like a common dirt scraper, is just the reverse. It was designed as a dirt pusher by the foreman of a gang of men at work on a high fill adjacent to a body of water. The teams could not drive down the steep dump, so the dirt was dumped on top and pushed over. The machine can handle 500 yd. of dirt per day with one team and two men. The second man sits on a plank extending out beyond the axle. The machine is so equally balanced that by his weight

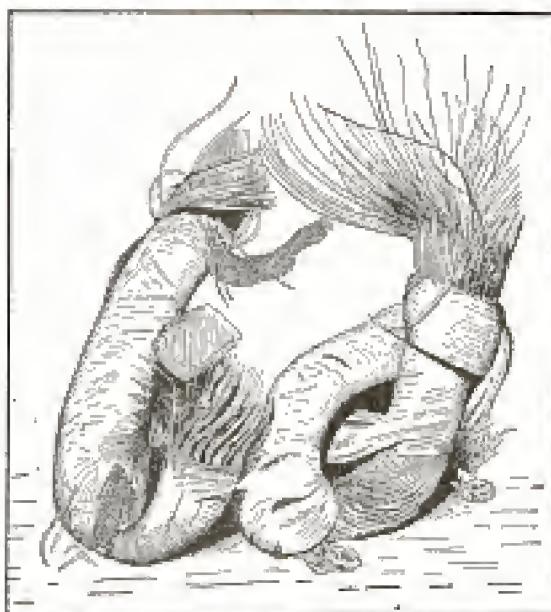


Novel Dirt Pusher

he can lift the "pusher" off the ground when returning for another push.

CABLE BADLY TWISTED

The extraordinary looking objects shown in this illustration, somewhat resembling a deep sea growth, are two of



Two Bad Kinks

the kinks found in one of the high tension feeder cables run across the harbor at Sidney, New South Wales, by the Sidney Electric Tramway Co.

Only recently service on the street car line was suddenly interrupted and it was found that a vessel dragging its anchor in the harbor during a storm had picked up the cables and effectually broken and snarled them up. As the cables were particularly stiff and heavy, it can be readily imagined that considerable force was necessary to bend them into such a snarl.

ICE BOAT AND STEAMBOAT RUN SIDE BY SIDE

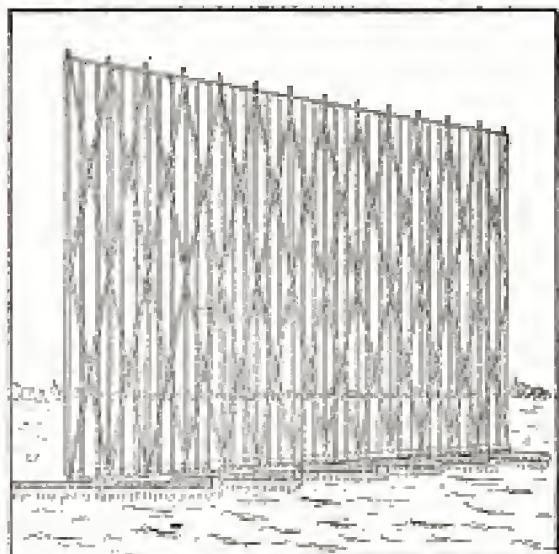
The unusual sight of an ice boat and a steamboat sailing along the same stretch of water is often seen during the winter months near Sandusky, Ohio. The vessel keeps a narrow channel broken through the ice by its frequent trips. The ice boats flash by on either side at a speed yet unattained by water craft.

DIVERT RIVER TO SAVE MINE

Fear that the Sturgeon river will break through and flood the underground workings of two iron mines near Iron Mountain, Mich., has caused the mining company to decide to divert the water into a new channel. The work will take six months, but its accomplishment will mean safety to men and property and make ore bodies available.

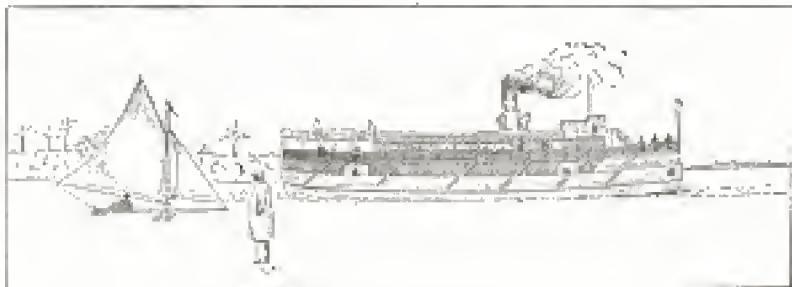
HUGE BATTLE-SHIP TARGET

This huge battle-ship target, about 60 ft. high and 100 ft. long, is now being used by the British navy for big



For Big Gun Practice

gun practice. The steel frame rests upon a raft or foundation of steel cylinders filled with compressed air. In practice the heavy missiles tear through the framework, leaving a jagged hole to show where the shot took effect. At the close of practice the target is towed back to its harbor and repaired.



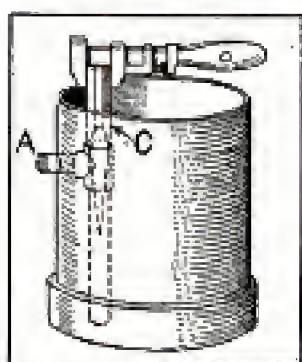


SHOP NOTES



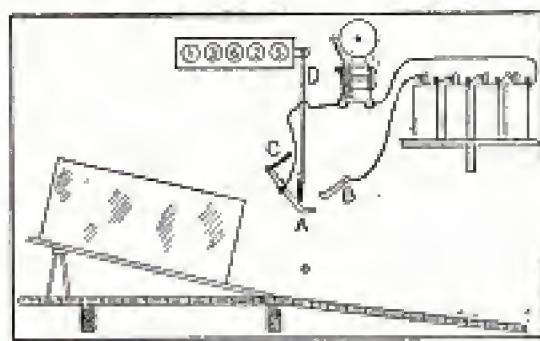
Unscrewing Pipe with a Chisel

The pipe in an oil filter became very tight after considerable use and as the filter was only 8 in. in diameter no wrench could be used to turn the pipe. After removing the nipple A, as shown in the sketch, a cape chisel, C, was inserted through the tee and into the pipe. With a wrench placed on the upper end of the chisel, the pipe was removed with ease.—C. H.



How to Make an Ice Block Recording Device

Managers of ice storage plants find it not easy to keep a correct record of the number of ice blocks stored. A small device can be made so the blocks of ice will do their own counting while passing a certain point in the course. The device consists of a small job press counter, which can be purchased at small cost, and a large vibrating bell, says a correspondent in Southern Engineer. Some dry batteries and insulated wire are also needed. The accompanying sketch shows the ar-

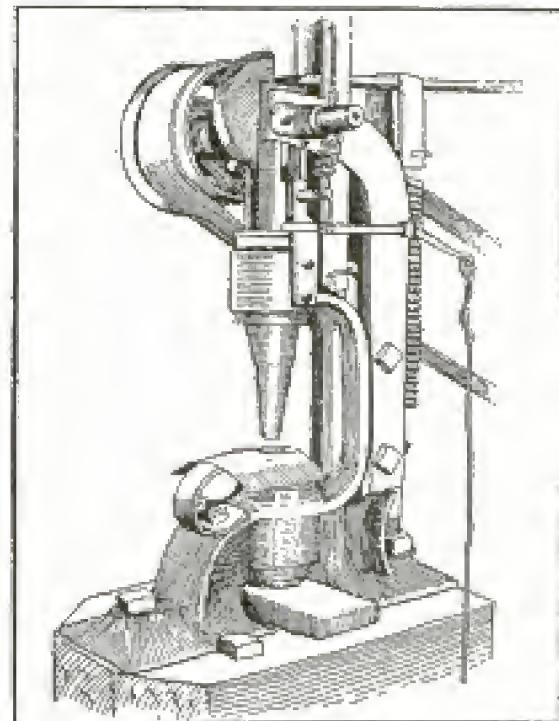


Ice Recording Device

angement. The cake of ice when passing beneath A presses this lever against B, which closes the circuit and causes the bell to ring, also operating the recorder by the small rod, D. After the cake of ice is passed, A is returned to its original position by means of the spring C. If it is not necessary to have a bell to ring, the electric bell and batteries may not be included.

Home-Made Riveting Machine

To construct a small riveting machine usually requires special patterns



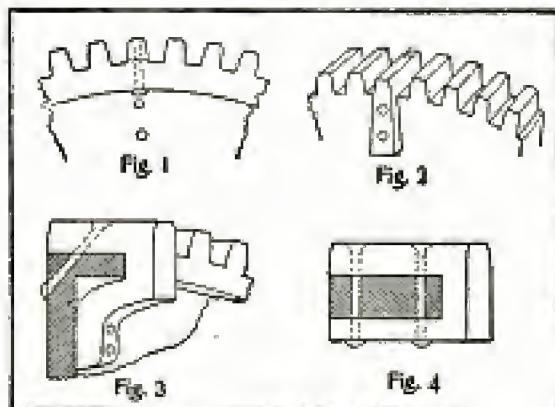
Riveting Machine

for castings and considerable machine work. The accompanying sketch shows how a small machine is built from a shaft hanger and a few easily made forgings, which does not require much time to construct and is efficient when put in operation. The plunger drop is $2\frac{1}{2}$ in. The cam should be made of tool steel and the working part or face

hardened. It will handle a $\frac{1}{2}$ - and $\frac{5}{16}$ -in. rivet nicely at 360 r. p. m.—Contributed by Jeane Carbon, Warwood, W. Va.

How to Insert a Cog in a Gear

A good method of placing repair cogs in a cast wheel is shown in the sketch. Hammer out a piece of wrought iron and bend it at an angle, leaving enough material to reach down on the web of the wheel twice the length of the cog (Fig. 2). Holes are drilled, and rivets placed in, as shown



Inserting a Cog in a Gear

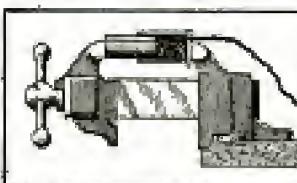
in Figs. 1 and 2. No groove is needed for the cog. If the projecting part interferes with the turning of the wheel, place the angle of the cog on the other side of the wheel (Fig. 3) and cut a notch in the side of the rim to make the cog come even with the outer edge of the rim. Bend the angle in to the web and rivet as before. If it is an open wheel, make the cog shaped like a U and let the rivets pass through as in Fig. 4.

Removing a Stuck Fountain Pen

Another way to remove a fountain pen when stuck is to wrap a wide rubber band around the nozzle several times, which will stick tightly to the hard rubber of the pen and furnish a good grip for the fingers. The pen can easily be unscrewed.—Contributed by Albert E. Welch, New York.

Making Vents in Cores

Select a piece of metal tube about 3 in. in diameter and 4 or 5 in. long, to which solder a metal plate over one end. Fit a plunger in the other end the same length as the tube. Drill a



small hole about $\frac{1}{16}$ in. or smaller through the metal plate close to one side of the tube. Fill the tube with molten wax and when partly cool place the plunger in the tube and place the whole in a vise as shown in sketch. Turning the vise screw will push the plunger into the tube, forcing the wax through the small hole which will make a wax string. These wax strings are moulded into the body of the core and when the core is baked the wax is burned, leaving a hole in the place of every piece of wax.—Contributed by Fred McVittie, Lima, N. J.

Automobile Used as a Hoist

The roof of a factory building was damaged by the falling of a tree and they decided to use the owner's automobile as a hoisting engine. This proved so successful that all the repair supplies were rapidly hauled on top. It may be suggested that the motor car might be made pay for itself on the farm by sawing wood, while on Sunday it could replace the old top buggy and take the entire family to church.



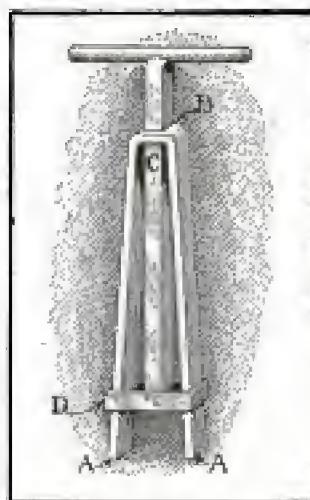
Hoisting with an Auto

A Simple Mission Stain

Mix boiled linseed oil and asphaltum together in portions of half and half and apply with a brush. In one or two minutes rub off with a rag and one of the finest mission stains is obtained. This may be varnished. One gallon will cover about 600 sq. ft. of smooth lumber.

How to Make an Adjustable Socket Wrench

Bend a piece of steel in the shape shown at A and make a square hole in it at the bend, B. Fit a square piece of iron, C, in this square hole.



Rivet a band, D, to the lower end, and weld a handle on the upper end of the iron, C. When using this wrench the jaws, AA, are pushed through the band, D, and placed on the nut in the socket. Pressure on the handle in turning will cause the jaws to grip the nut. The wrench can be made in various sizes to suit the requirements.

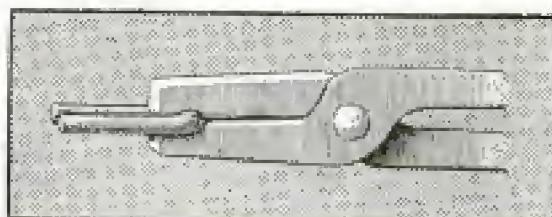
Quick Repairs on a Gas Generator Furnace

"One of our water-gas 'springer' sets burned the lining out of the firebox on New Year's day," says a member of the Pacific Coast Gas Association. "We had no time for ordinary repairs to the generator, so it was a question of immediate repairs. We pulled out the fire and made a protection from the heat above of sheet asbestos, doubled, so there would be an air space between. We then placed electric fans at the ash doors and with a relay of masons replaced the lining, covering an area of about 10 sq. ft. In spite of the trou-

mendous heat and the confined limit in which the work was done, a fire was started in the machine at 1:30 a. m., January 3rd, and gas was being made on the morning of the 4th.

Tongs for Holding Chain Links

Make a pair of common straight-jawed tongs, says a correspondent in the Blacksmith and Wheelwright. After heating the jaws to a working heat,

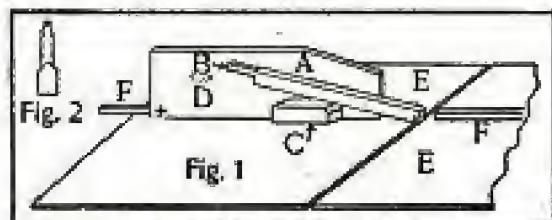


Chain Tongs

place a chain link between them and hammer enough to imbed the link in the jaws and let them cool.

Fitting Balusters to the Lower Porch Rail

A good way to saddle porch balusters to fit the beveled top of the lower rail is to make a device as shown in Fig. 1. EE is the saw table and D is a board with one corner cut off and block C nailed to one side along the lower edge, as shown. Put on a small saw



To Saddle Balusters

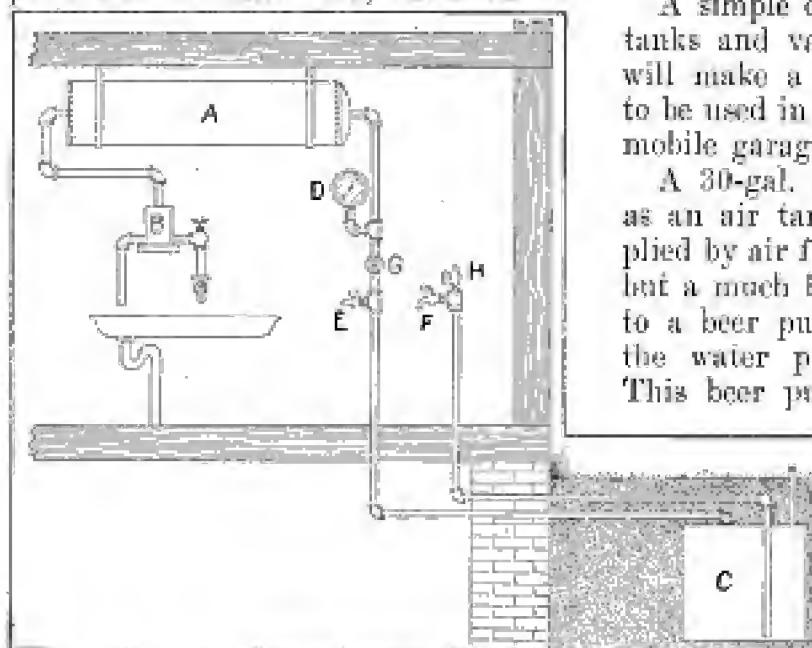
and place the board D against the guide FF, moving it along the guide until it is in position, so that when baluster, A, is placed in the position shown the saw will cut the desired bevel, says The Wood-Worker. Fasten the board D to the guide with a clamp.

Lower the saw or raise the table so that the saw cuts just half way through the baluster. Clamp the block B to the

board for a stop to put the end of the baluster against, as shown. Turn the baluster over and cut the other side. Balusters can be saddled this way in less time than they can be marked for sawing on a band saw. Fig. 2 shows the end view of the baluster and rail fitted together.

Cost of Reinforced Concrete Posts

A tract of land near Chicago, containing 62 acres, has just been fenced with 1,500 concrete posts, 1,000 of which were 9 ft. long and the remainder 7 ft. The average cost of the 9-ft. posts was 65 cents each, based on the



Gasoline Storage Tank Installed

following prices: Cement, \$2 a barrel; screenings, 75 cents a cubic foot; reinforcement steel, 3½ cents a pound, and the two laborers, \$2 a day each.

Each post was reinforced by four 1-in. corrugated bars, one on each corner. In casting a post, a layer of concrete was placed in a form, then two reinforcement rods were set in position, followed by another layer of concrete, the two other rods and the balance of concrete. The posts were kept wet three weeks after making, the first week of which they were covered. Two laborers were employed on the work, making an average of 40 posts a day, as well as mixing the concrete, and moving and watering the posts.

How to Prevent Wooden Faucets from Cracking

Place the faucets in melted paraffin that is heated to a temperature of 212 deg. F., and let them remain until the bubbles cease to rise from the wood. The whole is then allowed to cool to about 120 deg. F., when the faucets are taken from the bath and the adhering paraffin is removed by rubbing with a dry, coarse piece of cloth.

Gasoline Storage Tank

A simple connection of a few pipes, tanks and valves, as shown in sketch, will make a supply tank for gasoline to be used in plumbing shops and automobile garages.

A 30-gal. range boiler may be used as an air tank, A, which can be supplied by air from a common foot pump, but a much better way is to connect it to a beer pump which is operated by the water pressure from the mains. This beer pump, B, is placed near a sink and connected to the water supply pipe and the discharge piped to run into the sink. The gasoline tank, C, is placed in the ground outside of the building and fitted with a pipe

that will reach to the surface for filling. An air gauge, D, a globe valve, G, and a pet cock, E, are placed in the pipe between the two tanks. A faucet, F, and a pet cock, H, are connected on the end of the pipe leading from the gasoline tank.

The pump is started and the air tank filled (2 or 3 lb. pressure will raise gasoline) and everything is ready for use. The pet cock, E, is closed and the globe valve, G, opened, which brings the gasoline to the faucet, F. When not in use the globe valve, G, is closed and the pet cock, E, opened to relieve the gasoline tank of any air pressure.—Contributed by W. L. Brown, Seattle, Wash.

Etching on Steel

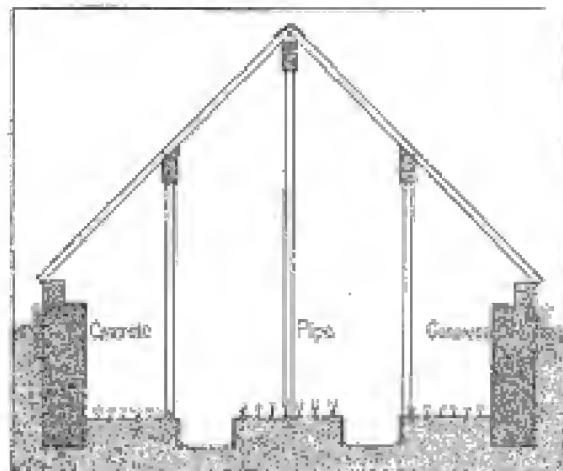
Take a piece of blue vitriol the size of a walnut, one tablespoonful of common salt, and mix with 8 oz. rain water. Let this solution stand for 8 or 10 hours and it is ready for use. Cover the part of the tool to be marked with paraffin or soap and scratch the name with a steel pen. Put on a few drops of the solution and let it remain for one minute and then rub off the solution and paraffin, or soap.

A Home-Made Greenhouse

A small house 36 ft. long, of even span, made in the following way, will prove useful and inexpensive. The foundation may be made of brick, concrete or grout, whichever is most convenient to build, and should be 12 in. wide and 3½ ft. high, of which 3 ft. is in the ground.

On this is built a frame the length of the house and high enough to hold a 14 by 24-in. pane of glass, the sash bars being set at right angles to the foundation. The top of the side frame is made of 4 by 4-in. stud, planed and finished like a hot bed sash frame, to hold the sash bars. The ridge, made of 2 by 4-in. material, is supported on iron pipe posts, which are strong and light. There are two rows of sash on each side of the house. Half of the distance between the ridge and the side there is a 2 by 4 running the length of the house and supported in the same manner as the ridge with pipe posts. The sash, 6 by 3 ft., glassed with 10 by 12 panes are just laid on and then held in place by two wood screws, which pass through the sash and take hold of the wood beneath.

Provision is made for ventilation by making every third sash of the upper row on each side of the house movable at its lower end. This admits fresh air just over the walks on both sides of the house. These ventilating sash are hinged to the opposite sash at the upper end, says *The Country Gentleman*. The joints of the sash are cov-

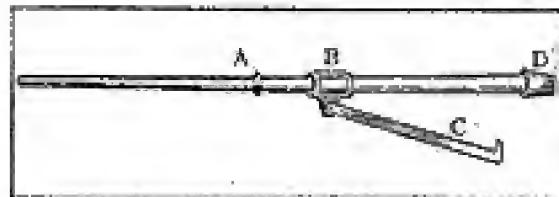


End View of Greenhouse

ered with weather strips to keep out the cold, and along the peak of the roof where the sashes come together there is nailed a strip of roofing paper, which turns the rain and snow. The beds are made directly on the ground, three in number, separated by sunken walks, a little over a foot in width and a foot deep. From the top of the middle bed to the peak is 6 ft.

How to Make a Bolt Holder

The accompanying illustration shows a very serviceable bolt holder for holding plow bolts and many other bolts that you want to hold, says a correspondent in the *American Blacksmith*. The bar consists of a piece of $\frac{3}{4}$ -in. round iron, 12 in. long, welded to a piece of $\frac{3}{4}$ -in. square steel about 15 in. long. The point of the welding be-

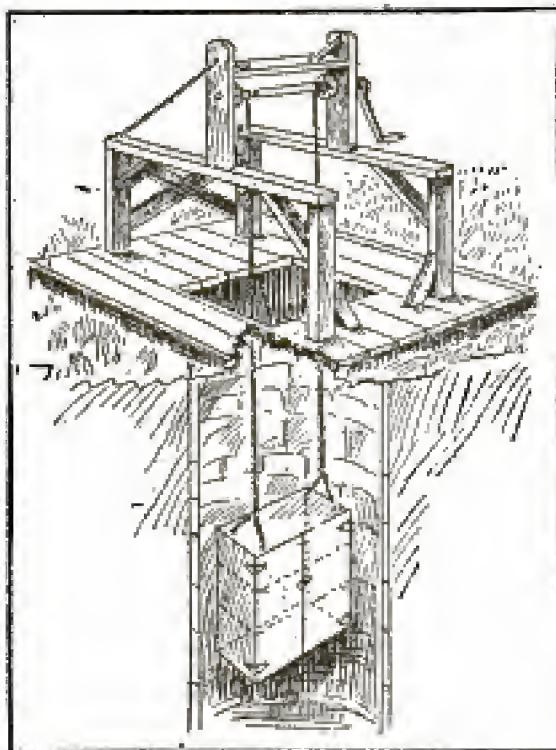


Bolt Holder

tween the iron and steel carries a shoulder, A. A slide as shown at B is made to slide over the piece of $\frac{3}{4}$ -in. square steel. The dog, C, is 6 in. long and the turn on the end is 1 in. long. The point of the bar at D is 2 in. wide and drawn to a chisel edge and tempered.

Using a Well to Cool Milk and Butter

On farms where ice cannot be conveniently obtained, or where facilities are not at hand for storing ice, the well



Milk and Butter Cooler

may be made into a very fair substitute. The accompanying cut shows how this may be done. A windlass is placed on a frame made of 2 by 4-in. material securely braced to prevent shaking, says Hoard's Dairyman. The size of the box depends on the size and shape of the well. The box is hung by two ropes to prevent its turning and should be strengthened with galvanized iron at the corners. If milk is to be cooled, it should be so placed that the box can be lowered into the water, otherwise the milk will not cool rapidly enough and may cause trouble from souring.

How to Make a Ground Glass

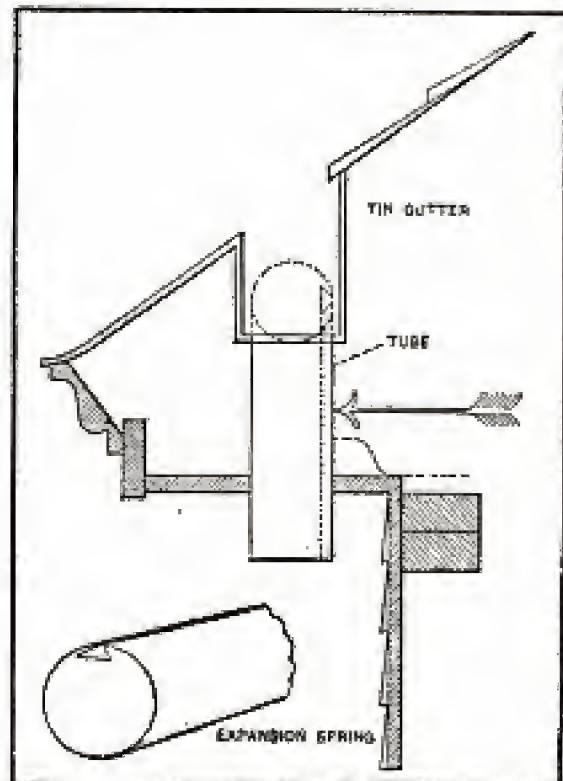
Take two old plates and remove the film. Cut them to fit the rabbeting in the ground glass frame of the camera by using a common glass cutter. Use flour of emery between the glass and

grind by giving them a rotary motion. If no flour of emery is at hand, use some fine emery cloth or paper soaked well in water and rubbed on one of the plates. A quantity of the emery will stick to the plate and the grinding is done in the same manner.—J. J. V.

To Prevent Leader Tubes from Bursting

The bursting of conductor pipes by the freezing of the water in them is not an uncommon occurrence. Schemes have from time to time been developed for securing a form of pipe that would allow for the expansion of the water in changing to ice, but these have failed in the long run, says The Metal Worker.

The cut shows a leader tube draining the valley back of a cornice. The elasticity of the tube, allowing it to expand when needed and yet to take its original form when possible, is effected by giving the sheet metal a re-entrant angular seam, the construction being indicated in the sketch. The expansion ring is also arranged outside of the pipe, where it is found to be equally ef-



Expansion Leader Tube

ficient, with the additional valuable feature that it affords a means for the fastening to the building. In other words, when the spring is on the outside of the pipe, it is suitable for use as a regular conductor pipe, and when it is within the pipe the pipe can be passed through a circular hole in a cornice, as illustrated in the cut. It is in this part of the roof drainage system that most of the leakage troubles occur, the successive freezing and thawing usually bursting the tube at about the point shown by the arrow.

The leaders are made of copper and of galvanized iron or tin and where for architectural reasons it is desired can also be rectangular in section, the expansion spring being provided in the same way.

How to Keep a Tap from Breaking

A great many small taps break just where the thread and shank meet. This point can be overcome almost entirely, says American Machinist, by drawing the temper at the point  as shown in sketch with a torch, a pair of hot tongs, or by dipping the shank into hot lead and letting the blue just begin to run into the thread.

How to Figure Radiation

A good rule for estimating radiation is as follows:

For water: 1 sq. ft. of radiation to every square foot of glass; 1 sq. ft. of radiation to every 10 sq. ft. of wall; 1 sq. ft. of radiation to every 150 cu. ft. of the contents of the room.

The foregoing rule refers to rooms with one exposure, says Building Management. In rooms with two exposures the ratio of cubical contents should be 1 to 100. For steam, take two-thirds of the above results for radiation.

It is best for a water and steam job to figure out the work as if it were to

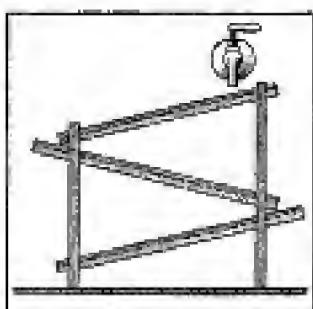
be for water, using the above water rule, and then for steam, take two-thirds of that result.

A Substitute for a Lock Nut

When a valve stem requires a lock nut but cannot be lengthened sufficient for one; also, when the single nut is too close to the end to admit another, drill a hole in the end of the stem and tap with a tapering tap as shown in Fig. 1. Slit the end of the valve stem with a hack saw (Fig. 2), and place a conical screw in the threaded hole as shown.

Home-Made Negative Washer

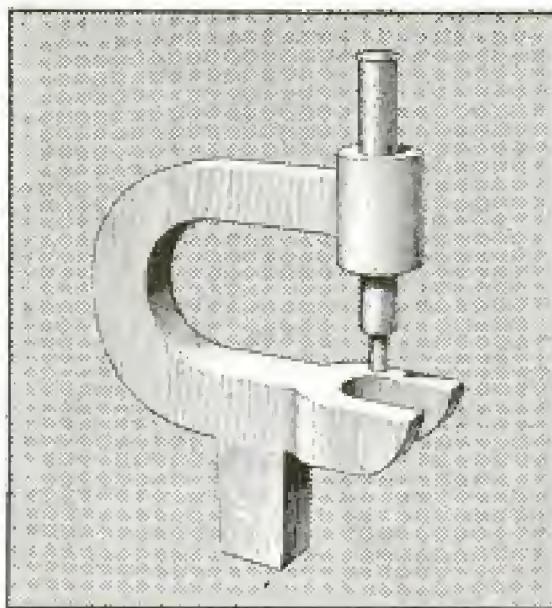
A very simple and efficient negative washer can be made of two or three boards the width of the negatives. A ledge $\frac{1}{2}$ in. high is fastened along each side of the boards. One end of one board is hung just below the tap and the water is allowed to run down it in a gentle stream, says American Photography. The upper end of the second board is placed just below the lower end of the first board, and so on for as many boards as desired and will fit under the tap and in the sink. The water runs from the first board on the succeeding boards and into the sink. The arrangement is shown in the sketch. The plates are laid, film side up, on the boards.



Denver has the largest American flag in the world. It measures 115 ft. in length and 58 ft. in width.

A Light Punch for Removing Rivets

The accompanying sketch shows how a punch may be made that will save the assistance of a helper, says the Blacksmith and Wheelwright. The



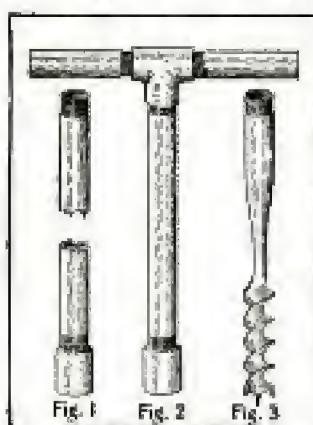
For Punching Rivets

body of the tool is forged out of a piece of iron with a projection on the bottom to fit the square hole in the anvil. The punch is a $\frac{3}{8}$ -in. steel rod drawn down to $\frac{3}{16}$ in. on the end, and is made to fit the hole in the arm a little loose. This makes a handy tool for removing rivets from light work.

A Home-Made Well Auger

Pumps are usually furnished with a $1\frac{1}{2}$ -in. pipe below the cylinder and in sinking the well it is found better

to bore a hole to gravel before driving the joint. An auger to bore this hole may be made out of an old wood auger 2 in. or more in diameter welded into a piece of $\frac{3}{4}$ -in. pipe as



shown in Fig. 3. Make a handle by fit-

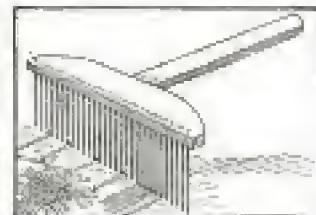
ting two pieces of pipe in a tee as shown in Fig. 2. Cut several pieces of $\frac{3}{4}$ -in. pipe about 6 ft. long to use in extending the handle as the hole is bored.

Utilizing Heat from a Gas Engine Exhaust

An enterprising laundryman recently had installed a 15-hp. gas engine to take the place of the steam engine he had been using. After installing the engine he connected the exhaust with the pipe which he had used for steam to heat a large mangle. It was a successful experiment, and saves the fuel otherwise necessary for that purpose.

How to Make a Handy Nail Picker

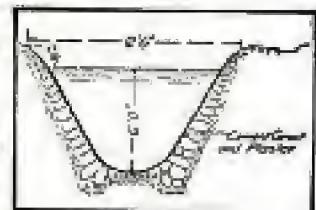
Cut a piece of hard wood $\frac{1}{2}$ in. thick and about 6 in. long in the shape as shown in the sketch, and attach a handle to it. To keep the wood from splitting, drill small holes in the edge of the wood in which to drive the nails as shown. Pulling this device through a bunch of nails will arrange them all straight and with the heads one way so they can be picked up by the hand ready for use.—Contributed by E. Kane.



Cobble Stones for Ditch Lining

The protection of earth slopes by means of a wall paved with cobble stones and plaster is proving effective in a number of irrigation canals constructed in this manner in California.

By this method the canal is lined with large cobble stones and small boulders, the stones of the side



walls imbedded in mortar and faced with cement to prevent loss of water by leakage. The larger cobble stones are placed at the base of the walls, gradually growing smaller as the top is reached. The walls are laid in irregular layers, cement mortar and stones being used for two-thirds their thickness and the rear third filled with slightly wetted earth.

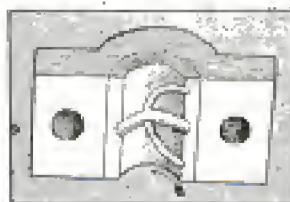
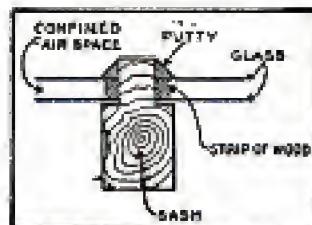
How to Place Glass for Small Greenhouse

The accompanying sketch shows how to place two sets of glass for a greenhouse or hot bed. The first set of glass is embedded in the sash with putty, says *The Rural New Yorker*. A small square strip of wood is then fastened to the sash and on the first set of glass as shown. The second set of glass is then laid in putty, placed on the strip of wood, and then finished with putty in the usual manner.

Cutting Channels in a Bearing for Graphite

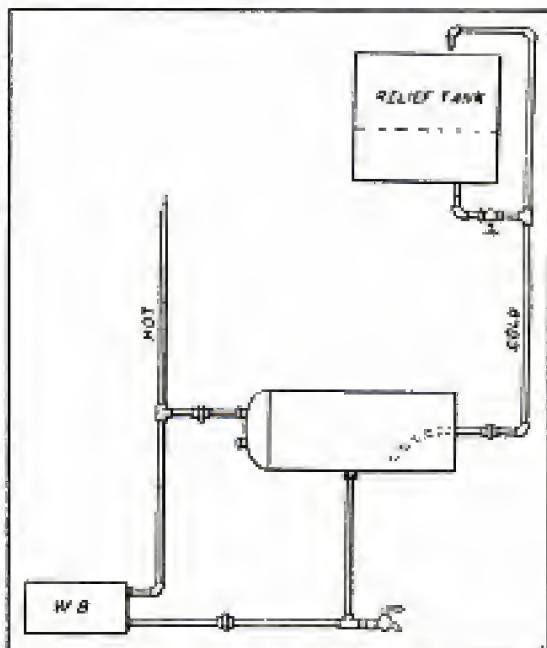
If flake graphite is to be used in a bearing, cut the channels in the babbitt as shown in the sketch. The side grooves should lead into the center groove in the direction the shaft turns. The center channel is the one to be filled with the graphite. Channels cut in this manner will give proper lubrication, also prevent the graphite from working out at the ends.

A German mechanic has built the smallest motor in the world. It is used as a scarf pin and is run by a battery in his pocket. He keeps it in constant operation.



Connecting a Horizontal Kitchen Boiler

A great many ways have been suggested in regard to connecting a kitchen boiler horizontally placed. Some of the ways are good ones, yet improvements

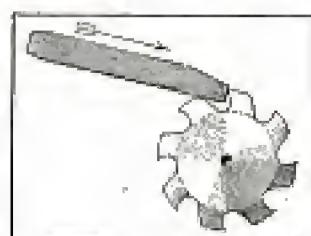


Connecting a Horizontal Boiler

can be made. The accompanying sketch shows a system of connections which is the most satisfactory way of connecting a range boiler in a horizontal position, says *The Metal Worker*. Making the connections in this manner provides a way to entirely empty the boiler, which is necessary on account of sand or sediment that will accumulate in the bottom.

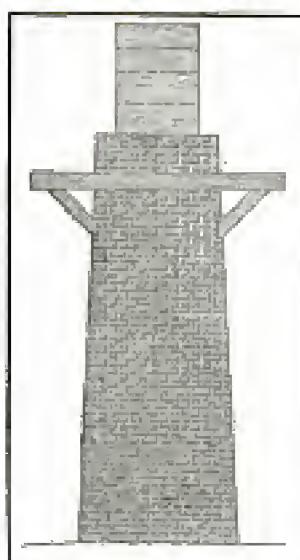
How to Make a Worn Reamer to Size

Anneal the reamer and with a flat end set drive against the cutting edge as shown by the direction of the arrow in the sketch. This will drive up a ridge that can be turned to size and then tempered.—Contributed by Charles W. Partridge, New Haven, Conn.



Extending a Brick Stack

The accompanying illustration shows how a brick stack may be raised while

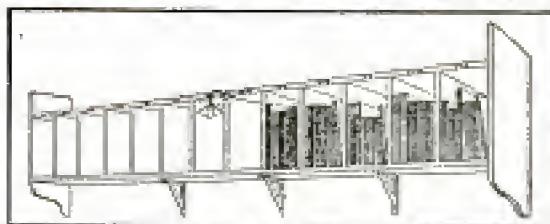


the power plant is kept in operation. The scaffold is bolted to the top of the stack with braces fastened into the side as shown. A wooden flue is made to fit the interior of the stack for the purpose of carrying away the smoke and gases which makes it possible for the brick layers to work.

The wooden flue is raised as the work progresses. This method was recently used to raise a brick stack from 60 ft. to 90 ft. high.—Contributed by C. R. McGahey, Cedartown, Georgia.

Catalog Case for Everyone

Catalogs are valuable text books, and it pays to make a case to keep them in. Take two pine boards about 1 in. by 10 in. by 12 ft. Make a shelf by fastening one of the boards to the wall with three 8-in. by 10-in. steel shelf brackets. Place the second board



The Catalog Case

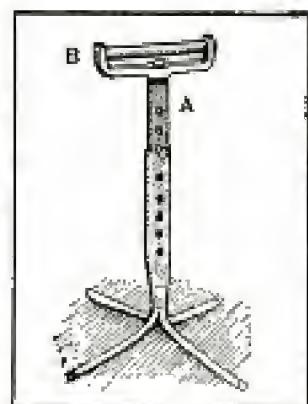
14 in. above the first and fasten to the partitions $\frac{3}{4}$ in. thick, dividing each section. Sandpaper until smooth, then oil, shellac and varnish. Neatly letter each division and place catalogs in section bearing the initial of maker's name. It is preferable to have one long shelf, but if crowded for room divide into two.

Some salesmen are more valuable

than others because they are familiar with the catalogs of the lines carried and know where to find the right book at the right time.

How to Make a Handy Shop Stand

A stand to be used in connection with the drill press when drilling long stock can be made as shown in the sketch. The body is made from 1-in. gas pipe flattened to receive the bar of iron, A. Four pieces of $\frac{3}{4}$ -in. round iron are welded in the bottom of the gas pipe and bent outward to form feet. The top, B, is made on a swivel attached to the bar, A, and is fitted with a roller. Holes are drilled through the gas pipe and the bar A in which to place a bolt for adjustment.

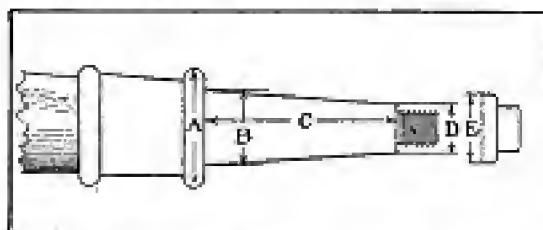


Removing Dents in a Gas Holder

A flood caused some damage to a gas holder, taking away the guide frames and making numerous leaks with some indentations in the holder itself, says a member of the Pacific Coast Gas Association. As the holder was an old one it was a question if the indentations could be removed. Temporary guide frames were erected and the holder raised up by a block and tackle with specially made hooks grasping the lower rim of the holder. While preparations were being made to force out the sides of the holder to their proper shape one of the blocks holding up the holder gave way, causing the other blocks to do the same, and the holder dropped back into the water of the tub. The air inside of the holder was compressed with such force that the indentations were removed by the pressure on the sides—doing gently and efficiently what was planned to do at considerable expense.

How to Measure a Wagon Skein

When ordering wheels to fit old or new skeins all the dimensions needed are those that are shown in the accompanying sketch. The diameters

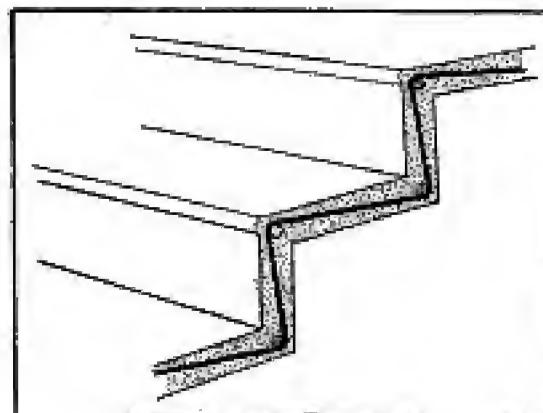


must be given at the largest part of the axle, B, and the smallest part, D, with the length, C. The diameter of the round part of the nut, E, should be given as well as the raised part at A.

How to Make Concrete Steps

Concrete may be used in the construction of steps, particularly in damp places, and in the open or where the ground is terraced, concrete steps and walks can be made exceedingly attractive. Where the ground is firm it may be cut away in the form of steps, with each step cut 2 or 3 in. lower than its finished level.

Where the nature of the ground will not admit of its being cut away in the form of steps, the risers are moulded between two vertical forms. The front one may be a smooth board, but the other should be a thin piece of sheet metal, which is more easily removed after the earth has been tamped in behind it, says the *Concrete Review*. A simple method of reinforcing concrete

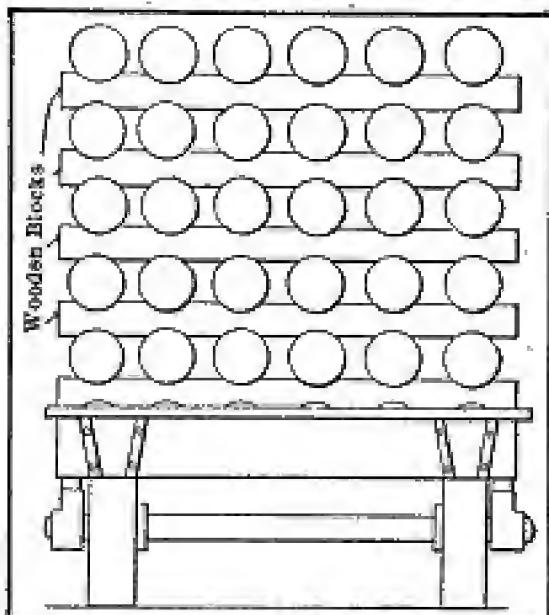


Reinforced Concrete Steps

steps is to place a $\frac{1}{2}$ -in. steel rod in each corner, and thread these with $\frac{1}{4}$ -in. rods bent to the shape of the steps, as shown in the sketch, placing them about 2 ft. apart. For this class of work a rich Portland cement concrete is recommended, with the use of stone or gravel under $\frac{1}{2}$ in. in size. Steps may be given $\frac{1}{2}$ -in. wearing surface of cement mortar mixed in the proportion of 1 part cement to 2 parts sand. This system is well adapted for stairways in houses.

How to Handle Heavy Bar Stock

Short, heavy bars are not easy to handle, and are dangerous to a workman's toes and fingers in a machine

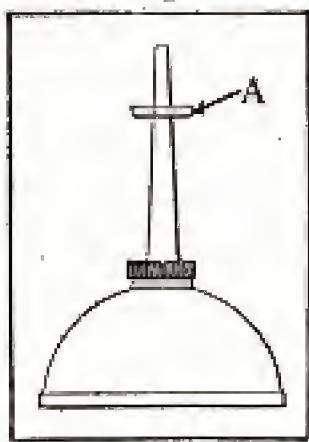


Handling Heavy Bars

shop. Such bars are generally piled up in the form of a pyramid, and in that shape they are difficult to handle, says *American Machinist*. A certain firm uses a great quantity of short, heavy steel bars. These bars are piled around the different departments of the shop mainly on trucks, as shown in the accompanying cut, which gives the end view of a truck load. Pieces of timber running across the truck are grooved to fit the bars and holding the bars apart, so that the workman can get his hands under them or pass a leather loop around them to lift with a hoist.

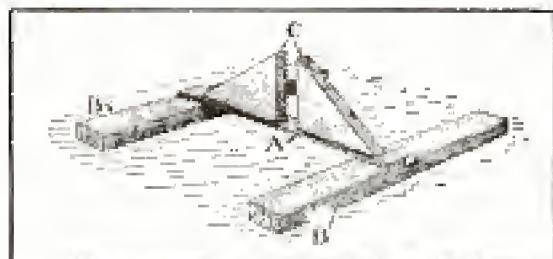
How to Prevent an Oil Can from Dripping

The accompanying sketch shows a kink in regard to oil cans. A leather washer is placed on the spout as shown at A, says a correspondent in *American Machinist*, which will prevent any oil from running down the outside of the spout on the bench, or wherever the can happens to be.



Quickly Made Door Jack

Make two blocks 8 in. long from 2 by 4 in. material and nail a common lath across them as shown in the sketch at A. Fasten two triangular blocks, C, made from a piece of 2 by 8 in. wood, to the lath, leaving a space between them. The door placed in this space with its weight on the lath, will bend



Door Jack

the lath down, bringing the tops of the angle blocks together like a vice. Lifting on the door opens the angle jaws and releases the door.—Contributed by E. E. Harriman, Los Angeles, Cal.

Building an Ice House

It is not necessary to have an expensive building for an ice house, but certain essentials must be observed, and the ice properly packed. In the first place the house should be tight and well drained at the bottom. How to

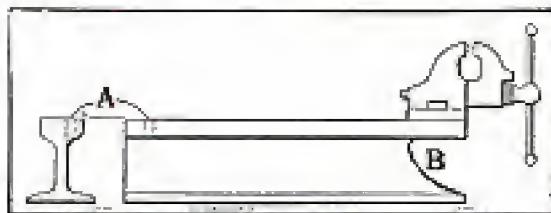
accomplish this depends somewhat on the conditions in each case.

The house in question was built on a clay bank. An excavation was made about 18 in. deep and some old railroad ties used for sills, with gravel to fill up the inside, and a porous drain tile put in around the outside and down the bank, the soil being well packed around the outside. The structure is on a frame of 2 by 4 in. studding, 14 ft. long. The house was sided with 12-in. barn boards, put on like clapboards and lapped 1 in. The roof is of ordinary tar felt. As an ice house must be well ventilated at the top, so that the packing will keep dry, a slatted ventilator 2 by 4 ft. was put in the roof, a floor laid loosely 10 ft. from the bottom and a layer of straw placed on this floor. The house is 18 ft. square.

By all means use sawdust for the packing, says *The Country Gentleman*. The ice is cut in cakes longer one way than the other, so that, in placing one layer on the other, joints may be broken; 22 by 28 in. is a good size. Sawdust is placed on the bottom about 6 in. thick and the cakes of ice are placed on this sawdust, keeping them away from the sides of the house about 1 ft. The cakes should be laid to fit as closely as possible and all the cracks and corners carefully chinked with fine particles of ice tamped in with a bar or some convenient tool. The next layer is placed in the same manner, taking care to break joints. When the house is packed the last melting will cause the whole mass to freeze in one solid block. As each layer is put in the house sawdust should be packed around the sides as firmly as it can be tamped down. About 2 ft. of sawdust is placed on top as the ice will gradually settle and need occasional packing around the sides. Remember to get the ice as clear as possible, and that the crop harvested in zero weather will keep much better than when gathered near the freezing point. Ice from 10 to 12 in. in thickness is the most convenient to handle, and there will be least waste.

Bench Vise Anvil

The accompanying cut shows a very handy bench vise anvil for the tool room, model-maker, or amateur mechanic. The anvil is made from a piece of steel rail about 12 or 15 in. long, and as heavy as can be obtained, and the top, edges and ends are planed smooth,

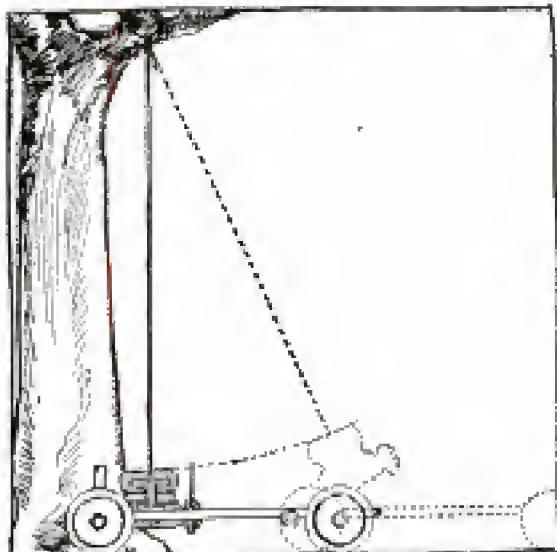


Bench Vise Anvil

true and square. The web is cut out, as shown at B, so a clamp or swivel vise of about $1\frac{1}{2}$ or 2 in. length of jaw, can be fastened to the end of the rail. A taper hole is made at A for the different shaped stakes. The top and edges may be case-hardened if so desired. This makes a handy outfit, says Machinery, as the top of the rail is a good place for straightening work, and the edges for bending work.

Lifting out a Motor

A good example of the ingenuity that is more often born of the lack of facilities than of repair shop necessity is sketched herewith. The problem in

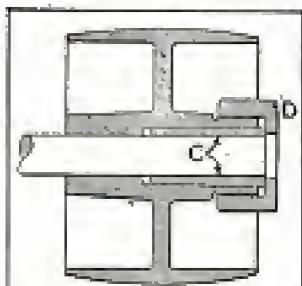


Lifting out a Motor

this case was to lift a 400-lb. motor out of a car which had to be dismantled a good many miles from the nearest block and tackle, says Motor Age. The engine was first freed of all piping and wiring, and unbolted from the frame. One end of a rope was tied about the engine, the other end being given a couple of turns around a horizontal limb of a tree directly overhead. All slack being taken out of the rope, one man maintained a slight tension on its free end, meanwhile keeping one hand on the motor to prevent its bumping around as it came loose, while another pushed the car back down a grade. As the rope swung out of the vertical, the engine had to lift until it was free from the frame, and after a few oscillations in the air it came to rest hanging like a pendulum from the limb. Easing up on the rope, the engine was brought to the ground.

How to Tighten a Pulley on Shaft

A certain electric motor gave trouble on account of the pulley tearing away the side of the keyseat, until at last the side of the groove gave away entirely. The shaft being of small diameter, another keyway would have weakened it still more, and the turning of another shaft would have compelled the dismounting of the machine. This was avoided by adopting the method shown in the sketch, says American Machinist.

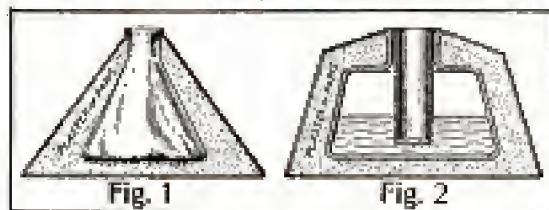


The hub of the pulley was tapered internally and threaded externally for a certain length. Three wedges, C, were obtained by cutting a solid piece with a hole of the diameter of the shaft and turning the outside taper to fit the taper in the pulley hub. These projected about $\frac{1}{4}$ in. and were forced between the pulley and the shaft by the

threaded collar, D. This simple arrangement will make a strong and sure grip on the shaft.

How to Make an Acid Receptacle

As glass is the proper material for a receptacle to hold acid, take an ink or mucilage bottle and encase it in sheet metal, as shown in Fig. 1, filling the space between the glass bottle and the metal casing with plaster of paris,

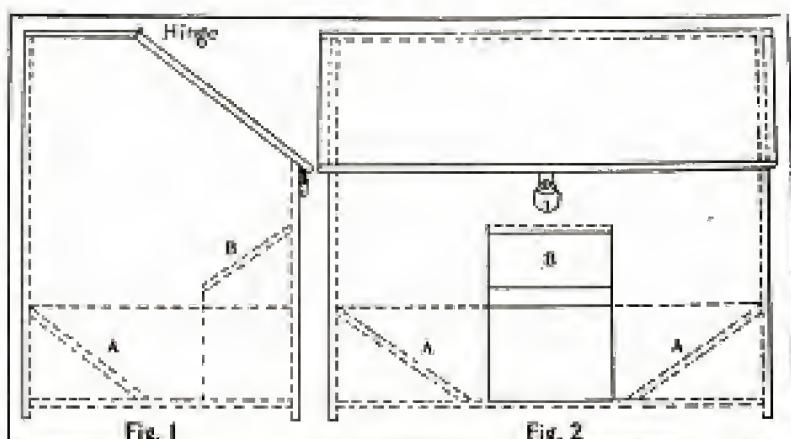


Will Not Tip Over

which will prevent the bottle from being broken or upset, says The Metal-Worker. The bottom is then soldered to it. If a bottle or mug can be obtained with an opening large enough to make a receptacle as shown in Fig. 2, it can be upset or fall from a roof and the acid will not be lost.

A Coal Bin for a Narrow Porch

A coal bin made as described makes a most excellent one for use on verandas of tenement buildings. In the sketch the bottom, A, is shown pitched from all sides toward the opening. This throws the last pieces of coal where they can easily be reached with a shovel, and without scraping around the corners. An inclined board, B, is placed over the opening which prevents the coal from falling and scattering over the floor. This board should not be less than 12 or 14 in. wide.—Contributed by Albert Pott, Waterbury, Conn.



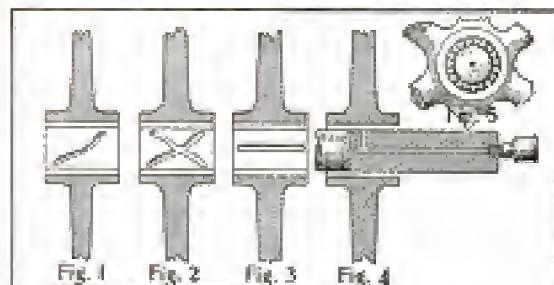
Details of Coal Bin Construction

remove the lining metal and fill the space with short rods of $\frac{1}{4}$ -in. round steel (Fig. 5).

A very good system of lubricating loose pulleys is to drill a hole from the

Lubricating Loose Pulleys

It is not always easy to properly lubricate loose pulleys. A correspondent of the Wood-Worker states that he had a loose pulley on a saw bench,



Prevents Hot Pulleys

even though it had an oil channel, that gave trouble. The pulley was fitted with a grease cup, so the grease could be forced in. The wheel would go for a while, but would soon get hot. When taken off, the end next the tight pulley was quite dry, the other end well greased. The oil channel was cut in the wheel, not straight through, but screw-wise, as shown in Fig. 1, and was drawing the grease away from that end. By cutting another channel in the opposite direction (Fig. 2) the trouble was overcome. The lesson taught is that straight through is the best line for an oil channel in loose pulleys (Fig. 3). Another plan, adopted as a make-shift, but seeming to answer well, is to

end of the spindle to the middle of the place where the loose pulley runs, then drill a hole from the side to meet it (Fig. 4). The grease cup is fastened in the end of the spindle so the grease can always be supplied where most wanted; that is, when the machine is idle and the loose pulley at work. There are cases where this arrangement is hardly practical, but it could often be adopted with advantage.

A Door Bell Substitute for the Deaf

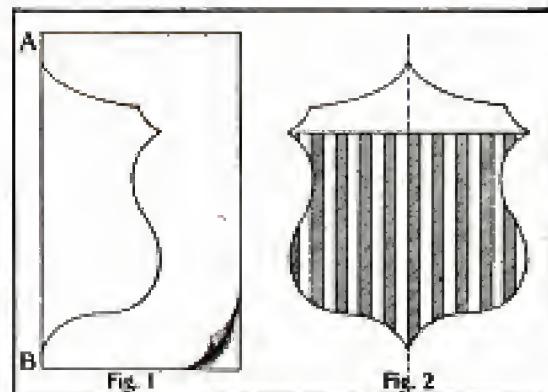
As red lights can be noticed any time during the day or night a little device constructed as shown in the sketch, to place in connection with the bell circuit, will make a fine arrangement for those that do not have good hearing.

The front view of the device is shown in Fig. 1, and the end view, Fig. 2. In this instance three drops are needed—for the front door, hall door and the side entrance. As the rooms have electric lights, the lights in each room are wired to the panel box by breaking one wire and connecting as shown in Fig. 1. When the circuit is closed on one of the bells, it also operates the magnet holding the drop in the same circuit. This releases the drop and the knife switch, K, closes the light circuit.

The sketch shows one of the drops complete at A, Fig. 1. The drops are returned to their position by the crank, D, and the little projections, E.—Contributed by H. B. French, New York.

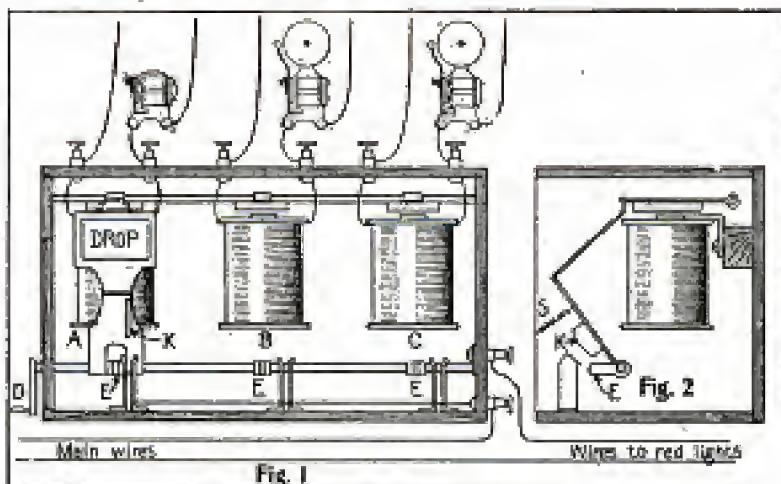
A Kink for the Sign Writer

To draw an object that has two sides alike is one of the hard things encountered by the sign writer. A good way to do this is to take a piece of paper, a little larger than the object to be drawn, and fold it in the center,



Pattern with Two Like Sides

as shown at AB Fig. 1. Commencing at the fold cut out one side of the object. Unfold the paper and the part cut out will make a pattern with both sides alike.



Flash Lights and Door Bells

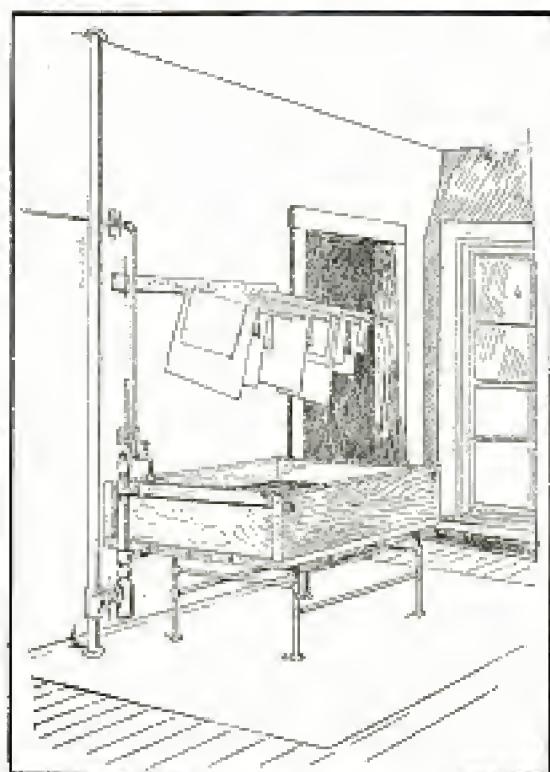
Trouble in Starting a Gasoline Engine

The bucking and snorting refusal in starting a gasoline engine is often due to moisture in the cylinder, states Power and Transmission, preventing the regular ignition until dried by the heat of several explosions. The difficulty may be overcome by shutting off the cooling water a few minutes before starting of the engine and not turning it on again until after the engine begins to explode regularly when again started. The hint here contained may be of use to the autoist who has trouble of this nature in cold weather where extra cylinders next to fire are left full of gasoline vapor and air, which condenses when the cylinder

walls get thoroughly cold and deposits considerable moisture.

Blueprint Washing Tank

The capacity of cylindrical machines for printing blue and sepia papers is so great that special preparation for



Blueprint Washing Tank

developing the prints is necessary. A wood sink 5 ft. long, 40 in. wide and 12 in. deep, inside measure, lined with zinc, seems to meet every requirement. There should be no standing overflow plug or other obstruction inside to interfere with floating the paper. The boards may be of any clear 1½-in. material with the ends mortised into the sides 2 or 3 in. from the ends. The bottom can be nailed flat to the frame. One ½-in. tie rod near the top at each end, in addition to good nailing will keep the frame in good shape, says *The Metal Worker*. The bottom pieces should not be over 8 in. wide, grooved and stripped, and not nailed nearer than 2 in. from the joint. Bevel the frame inward at the top so as to make the depth ½ in. less at the inside edge than from a line stretched over

the top. If the zinc lining is held snugly to the bevel and evenly bent at both angles and tacked to the outside, shrinkage of the frame in height will merely square up the top to some extent, while if the lining is bent over a square top, shrinkage soon inclines the top outward so that drippings run on the floor and the acute angle without support is more easily injured. The sketch shows a ½-in. pipe frame support under the tank. No better means than pipe will be found, but in any event the tank or sink should rest on strong cleats or girders that entirely cross the bottom. Cast soil pipe or galvanized wrought pipe will do for the waste. The trap should hold a good body of water.

To control the waste outlet and maintain the level desired (nearly full), a standing bath waste gives the best service. A standing waste as purchased has the overflow too high, but it is only necessary to drill some holes in the stand pipe at the proper level, after the waste is in place.

Setting Electric Light Poles in Frozen Ground

The following method was used in placing electric light poles in frozen ground: Steam was obtained from the boiler of an ordinary traction engine and conveyed through a pipe to a vertical jet pipe, says *Engineering-Contracting*. The jet pipe was connected by a tee to a horizontal pipe, 24 in. long, capped at one end and connected at the other by nipples and four elbows to the steam pipe. The nipples and elbows were placed to allow the necessary play in handling the appliance. The jet pipe was manipulated by two wooden handles 10 ft. long, connected by stirrups to the two ends of the 24-in. horizontal pipe. The jet pipe was forced down by two men pressing on the handles, and as the earth thawed, the steam would carry the particles out alongside the pipe. As the depth increased, more steam would be condensed in the hole, until finally the overflow was liquid mud.



Amateur Mechanics



A Microscope Without a Lens

By E. W. Davis

Nearly everyone has heard of the pin-hole camera, but the fact that the same principle can be used to make a microscope, having a magnifying power of 8 diameters (64 times) will perhaps be new to some readers.

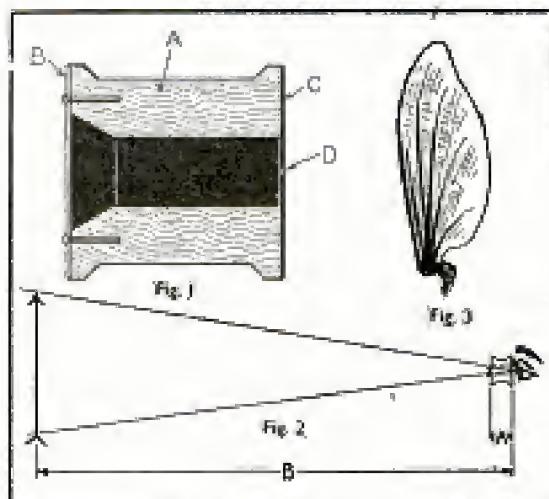
To make this lensless microscope, procure a wooden spool, A (a short spool, say $\frac{1}{2}$ or $\frac{3}{4}$ in. long, produces a higher magnifying power), and enlarge the bore a little at one end. Then blacken the inside with India ink and allow it to dry. From a piece of thin transparent celluloid or mica, cut out a small disc, B, and fasten to the end having the enlarged bore, by means of brads. On the other end glue a piece of thin black card-board, C, and at the center, D, make a small hole with the point of a fine needle. It is very important that the hole D should be very small, otherwise the image will be blurred.

To use this microscope, place a small object on the transparent disc, which may be moistened to make the object adhere, and look through the hole D. It is necessary to have a strong light to get good results, and, as in all microscopes of any power, the object should be of a transparent nature.

The principle on which this instrument works is illustrated in Fig. 2. The apparent diameter of an object is inversely proportional to its distance from the eye, i. e., if the distance is reduced to one-half, the diameter will appear twice as large; if the distance is reduced to one-third, the diameter will appear three times as large, and so on. As the nearest distance at which the average person can see an object clearly is about 6 in., it follows that the diameter of an object $\frac{1}{2}$ in. from the eye would appear 8 times the normal size. The object would then be mag-

nified 8 diameters, or 64 times. (The area would appear 64 times as large.) But an object $\frac{1}{2}$ in. from the eye appears so blurred that none of the details are discernible, and it is for this reason that the pin-hole is employed.

Viewed through this microscope, a fly's wing appears as large as a person's hand, held at arm's length, and has the general appearance shown in Fig. 3. The mother of vinegar examined in the same way is seen to be swarming



Details of Microscope

with a mass of wriggling little worms, and may possibly cause the observer to abstain from all salads forever after. An innocent looking drop of water, in which hay has been soaking for several days, reveals hundreds of little infusoria, darting across the field in every direction. These and hundreds of other interesting objects may be observed in this little instrument, which costs little or nothing to make.

Prince Rupert's Drops

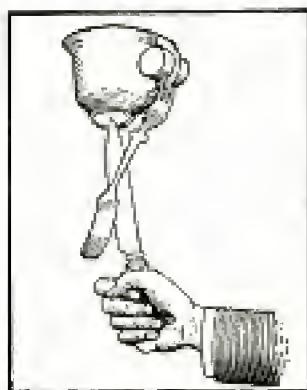
Prince Rupert's drops are made by letting drops of melted glass fall into cold water. These drops become oval in shape with a tail or neck resembling a reort. Their peculiarity is that when a small portion of the tail or neck is

broken off the whole bursts into powder with an explosion and a considerable shock is felt by the hand that grasps it.

How to Balance a Cup on a Knife

If you were told that you could balance a cup one-quarter full of coffee

on the point of a carving knife you would hardly believe it. Insert a cork in the handle of a cup tightly, says the Detroit Free Press. Stick two of the prongs of a fork into the cork, in the position shown in the sketch. This arrangement lowers the center of gravity of the whole, and if you have a steady hand, you may now place the cup on the point of the knife.



position shown in the sketch. This arrangement lowers the center of gravity of the whole, and if you have a steady hand, you may now place the cup on the point of the knife.

Photographs Lightning Flash

This interesting letter and lightning flash photograph were received from Fred M. Roberts, Paterson, N. J., and describe how he profited from an article published in Popular Mechanics.

“Receiving a suggestion from an article published in Popular Mechanics on the subject of photographing lightning flashes, I took my camera out and focusing it on the setting sun marked its position on the scale. This

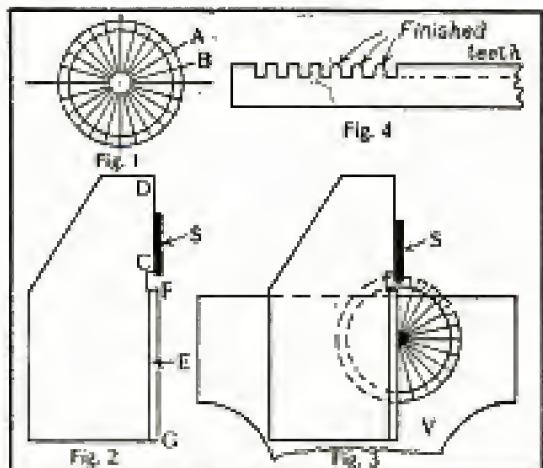


Brilliant Cloud Effect

enabled me to obtain the correct focus quickly the first night an electrical storm occurred, with a result, as you can see, to be proud of. The exposure was taken about 8:30 o'clock in the evening with the camera set due south. I had often thought of the possibilities of photographing flashes but never gave it a trial until after reading the above mentioned article.”

How to Make Small Gear Wheels Without a Lathe

To make small models sundry small gears and racks are required, either cut for the place or by using the parts from an old clock. With no other tools than a back-saw, some files, a compass and with the exercise of a little patience and moderate skill, very good teeth may be cut on blank wheels.

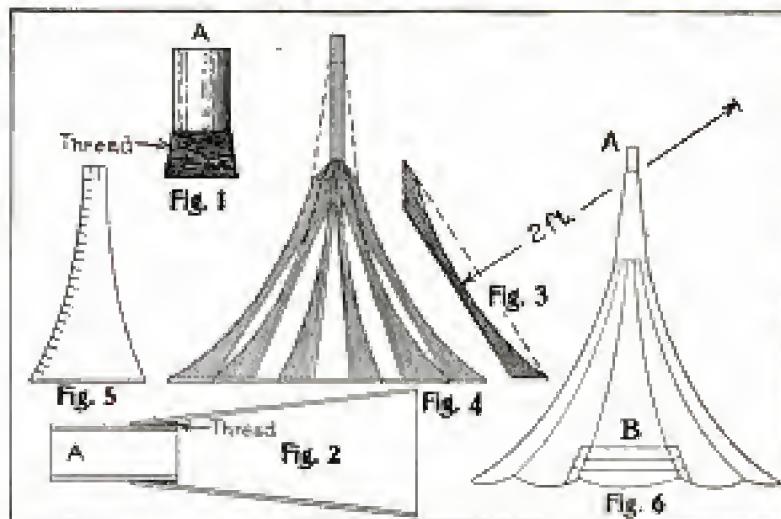


Making Model Wheels

First take the case of a small gear-wheel, say 1 in. outside diameter and $\frac{1}{16}$ in. thick, with twenty-four teeth. Draw a circle on paper, the same diameter as the wheel. Divide the circumference into the number of parts desired, by drawing diameters, Fig. 1. The distance A B will be approximately the pitch. Now describe a smaller circle for the base of the teeth and half-way between these circles may be taken as the pitch circle.

Now describe a circle the same size as the largest circle on a piece of $\frac{1}{16}$ -in. sheet metal, and having cut it out and filed it up to this circle, fasten the

marked-out paper circle accurately over it with glue. Saw-cuts can now be made down the diameters to the smaller circle with the aid of a saw guide, Fig. 2, made from $\frac{1}{8}$ -in. mild steel or iron. This guide should have a beveled edge, E from F to G, to lay along the line on which the saw-cut is to be made. The straight-edge, C D, should be set back one-half the thickness of the saw-blades, so that the center of the blade, when flat against it, will be over the line F G. A small clearance space, F C, must be made to allow the teeth of the saw to pass.



Details of Phonograph Horn

The guide should then be placed along one of the diameters and held in position until gripped in the vise, Fig. 3. The first tooth may now be cut, care being taken to keep the blade of the saw flat up to the guiding edge. The Model Engineer, London, says if this is done and the saw-guide well made, the cut will be central on the line, and if the marking out is correct the teeth will be quite uniform all the way round. A small ward file will be needed to finish off the teeth to their proper shape and thickness.

In making a worm wheel the cuts must be taken in a sloping direction, the slope and pitch depending on the slope and pitch of the worm thread, which, though more difficult, may also be cut with a hacksaw and file.

A bevel wheel should be cut in the same manner as the spur wheel, but the

cut should be deeper on the side which has the larger diameter. To cut a rack the pitch should be marked along the side, and the guide and saw used as before (Fig. 4).

How to Make a Paper Phonograph Horn

Secure a piece of tubing about $1\frac{1}{2}$ in. long that will fit the connection to the reproducer, and wrap a quantity of heavy thread around one end as shown in the enlarged sketch A, Fig. 1. Form a cone of heavy paper, 9 in. long and 3 in. in diameter, at the larger end with the smaller end to fit the diameter of the tube A, making it three-ply thick and gluing the layers together. Attach this cone on the tube A where the thread has been wrapped with glue, as shown in Fig. 2. Fig. 2 is also an enlarged sketch. Make ten pieces about 1 ft. 10 in. in length and 3 in. wide from the thin boards of

a biscuit or cracker box. Cut an arc of a circle in them on a radius of 2 ft. (Fig. 3). Make a stick 10-sided, 12 in. long, that will fit loosely in the tube, A, to which nail the 10 pieces as shown in Fig. 4, connecting the bottom by cross pieces, using care to keep them at equal distances apart and in a circle whose diameter is about 2 ft.

The cone is placed over the stick as shown by the dotted lines in Fig. 4 and temporarily fastened in position. Cut out paper sections (Fig. 5) that will cover each space between the 10 pieces, allowing 1 in. on one side and the top in which to cut slits that will form pieces to overlap the next section and to attach with glue. Fasten the sections all around in like manner. The next course is put on in strips overlapping as shown at B, Fig. 6. Finish by putting on sections in the same way

as the first course, making it three-ply thick. Remove the form, trim to suit and glue a piece of paper over the edge. When the glue is thoroughly hardened, put on two coats of white and one of blue paint, shading it to suit and striping it with gold bronze.—Contributed by B. H. Haver, Houston, Tex.

How to Bind Magazines

An easy way to bind *Popular Mechanics* in volumes of a year each is to arrange the magazines in order and tie them securely both ways with a strong cord. It is well to put two or three sheets of tough white paper, cut to the size of the pages, at the front and back for fly leaves.

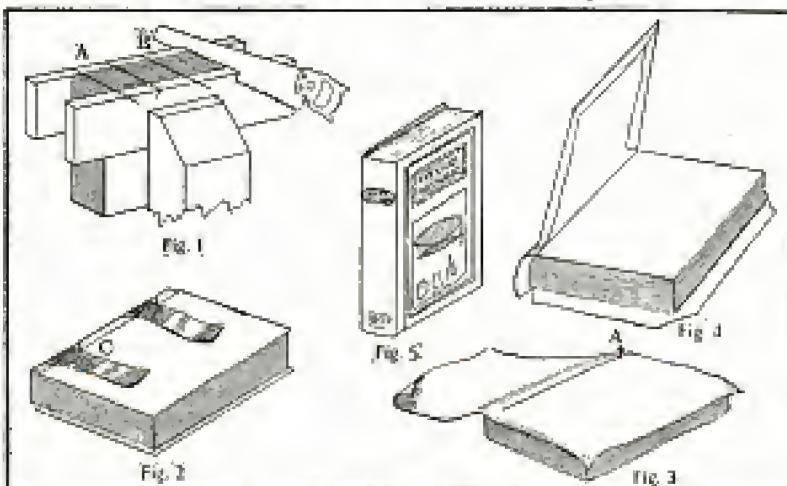
Clamp the whole in a vise or clamp with two strips of wood even with the back edges of the magazines. With a sharp saw cut a slit in the magazines and wood strips about $\frac{1}{4}$ in. deep and slanting as shown at A and B, Fig. 1. Take two strips of stout cloth, about 8 or 10 in. long and as wide as the distance between the bottoms of the sawed slits. Lay these over the back edge of the pack and tie securely through the slits with a string thread—wrapping and tying several times (C, Fig. 2).

If you have access to a printer's paper knife, trim both ends and the front edge; this makes a much neater book, but if the paper knife cannot be used, clamp the whole between two boards and saw off the edges, boards and all, smoothly, with a fine saw.

Cut four pieces of cardboard, $\frac{1}{4}$ in. longer and $\frac{1}{4}$ in. narrower than the magazines after they have been trimmed. Lay one piece of the board on the book and under the cloth strips. Use ordinary flour paste and paste the strips to the cardboard and then rub

paste all over the top of the strips and the board. Rub paste over one side of another piece of board and put it on top of the first board and strips pressing down firmly so that the strips are held securely between the two boards. Turn the book over and do the same with the other two boards.

After the paste has dried a few minutes take a piece of strong cloth, duck or linen, fold and cut it 1 in. larger all around than the book, leaving the folded edge uncut. Rub paste over one of the board backs and lay one end of the cloth on it, smoothing and creasing as shown at A, Fig. 3. Turn the book over and paste the other



Process of Home-Made Binding

side. The back edges should have a good coat of paste and a strip of paper the width of the thickness of the pack pasted on before pasting the cloth to the second board back.

Cut off the corners and fold over the edges of the cloth, pasting them down (Fig. 4). Rub paste on one side of a fly leaf and press the back down on it. Turn the book over and paste a fly leaf to the other back after the edges of the cloth have been folded down. The backs must not be opened until the fly leaves are thoroughly dry. Trim and tuck in the ends of the strip at the back edge.

When fixed this way your magazines make one of the most valuable volumes you can possibly add to your library of mechanical books.—Contributed by Joseph N. Parker, Bedford City, Va.

FARMERS' ADVERTISING BULLETIN

An advertising bulletin board, similar to the one shown in this illustration, placed at a central point in a rural community, has proved an excellent arrangement to draw farmers together to make good sales and satisfactory trades. The bulletin consists of a blackboard on which the farmers offer farm stock, machines, etc., for sale or trade. Ignoring the bulletin's value to the farmer alone, the manager of an elevator company who has placed one of the boards on the side of his building, says that he would not part with it for \$100.

DECK OF A LAKE FREIGHTER

To stand on the bridge of one of the big 600-ft. lake freighters and look down the long, bare expanse of steel deck, only broken by low hatchways, to the boiler house and after cabins is a sight calculated to make a person almost lonesome. For a stretch of 450 ft. nothing breaks the barrenness, and it is quite as possible to get



Photo by W. H. Johnson

Longer Than a City Block

Farmers' Wants
or Whom it May Concern

*Auction March 10 at Black horse for sale
Sam Smith's farm by Ed Huckleberry.*

*Work team to trade
for family surrey.
Ed Johnson*

*Choice seed wheat for
sale by Farmers' Elevator Co.*

away from the rush and stress of things as in a "deserted village." A few trips each day from after cabin to pilot house, with the wind almost lifting you off your feet, is as much of a constitutional as most people care to take on land.

PADDED COSTUMES FOR AERONAUTS

A European aeronaut has devised a padded suit for use on ballooning trips. With this suit he expects to escape the bruises which every aeronaut gets now and then when making descents.



RIVER TELEPHONE SERVICE

To insure the safety of large ocean vessels running through the St. Lawrence river from Montreal to Quebec, a distance of 180 miles, the Canadian Department of Marine Fisheries has established a marine signal system of telephones by which captains can be warned of unusual or unexpected dangers to be avoided.

THE WORLD'S CRY FOR TRAINED MEN

THE MAN WHO GETS A BIG SALARY— HOW HE GETS IT—WHY HE GETS IT.

By VICTOR FORTUNE.

There was once a time when it was extremely difficult for anyone without years of schooling to succeed in life.

Now it is different. Look where you will today—in whatever walk of life—you will find men who have risen from small positions to places of importance and independence—commanding the respect of themselves and their fellow men.

The "dollar-a-day" man is not a real man. He has long ceased to be considered a factor in any business. He is merely a cog—a small part of a wheel. His little responsibility ceases with the 6 o'clock whistle. His pay doesn't increase. He knows that if he loses his job there are a hundred and one other men as good as he waiting to fill it.

But with proper training this man *can* succeed. Where before he was merely tolerated, *training* puts him in *demand*. He commands a better salary, and goes on *earning more all the time*.

But how is he to get this training? His hours are long—his capital small—often he lives miles from any large center where such a training is to be had. A few years ago such a question would have been hard to answer; but today, with a great man-helping institution such as the International Correspondence Schools at the ready command of every untrained man, the solution of the difficulty is, indeed, simple.

NOW EARNS MORE A DAY THAN HE FORMERLY DID IN A WEEK.

When R. E. Tuttle of 230 Highland Ave., Portland, Me., first enrolled with the I. C. S. he was a clerk earning only \$10.00 a week. Tuttle says: "I am now a general

contractor and civil engineer, and *earn sometimes more per day now than I did per week when I enrolled*. I unhesitatingly recommend the I. C. S. to the serious consideration of every ambitious man."

MADE UP HIS MIND TO BE PROMOTED, TOO.

Another man, formerly a general shop hand, says: "I saw a number of men promoted to positions much higher than I held, and became a little discouraged. Since enrolling with the I. C. S. I have been gradually advanced to the position I now hold as electrical engineer of Yonkers Works of the Otis Elevator Company at *five times my former salary*—due entirely to I. C. S. instruction."

From shop hand to electrical engineer—think of it! Yet this experience of Frederick W. Newell of the Otis Elevator Company, Yonkers, N. Y., is but one of thousands of other parallel cases where the I. C. S. has helped men to success.

Doesn't this prove that training counts?

HIS WAGES INCREASED 250 PER CENT.

It is an error to suppose that to become proficient in any line of work requires a long course of college study, absence from home, and large capital. The I. C. S. will train you in *your spare time* without requiring you to leave home or lose a day's work.

This is especially evident in the case of R. A. Nortling, 311 High Street, Aurora, Ill., whose wages since enrolling with the I. C. S. have increased 250 per cent—two and one-half times the amount he received before the I. C. S. put him on the road to

success. Norling writes: "I was working as a factory hand at the Elgin Watch Factory when I took out my course in the I. C. S. I now have charge of the pattern-making, experimental room, and the drafting room of the Aurora Automatic Machinery Company. My earnings have increased 250 per cent. since I enrolled. I have secured many patents on special mechanical devices, and feel that my own experience warrants me in recommending the I. C. S. to any ambitious man who wishes to advance in his trade."

There surely must be something in training when it will take a man from the factory bench and raise him to such a position of importance, and almost treble his salary.

Not only this, but it develops a man's inventive powers—powers that would otherwise remain dormant and unproductive. Norling says: "I have secured many patents on special mechanical devices." Norling knew he had this gift, but not until he and the I. C. S. got together did he find himself able to turn that gift into dollars and cents.

OFFICE BOY BECOMES ASSISTANT TO PRESIDENT.

The interesting story of the office boy's rise to success has often been told. The I. C. S. has made it a *fact*. The following experience of L. J. Hellenthal, of 18 Ward Street, Seattle, Wash., is positive proof that I. C. S. training is not only for the grown-up, but also for the youth—the boy just starting out to make his own living.

This young man says: "My I. C. S. course has certainly been a great benefit to me. I enrolled when I was an office boy. I am now assistant to the President of the Union Machinery and Supply Company, and have increased my earnings from \$5.00 a week to \$150 a month.

NO AGE LIMIT.

It was young Hellenthal's good fortune to realize, in time, the importance of training, with the result that his promotion has been rapid. But the I. C. S. has no age limit. Some of the most successful men

the I. C. S. has developed were past their prime when they enrolled. These men had been filling menial positions, and not until they joined the I. C. S. did they break the bonds that had held them in the ranks of poorly paid and dissatisfied men.

RULE OF THUMB VS. RULE OF MIND.

Rule of thumb works well enough up to a certain point, but there it stops. By opening a throttle you can set a train in motion, but unless you understand the principle by which the steam drives the huge wheels, you cannot be considered an engineer.

To succeed in any trade, business or profession, it is absolutely necessary to thoroughly understand the *hows, whys and wherefores—the very instruction that the I. C. S. gives.*



WHICH POSITION CAN YOU FILL?

This is exemplified in the case of J. H. Reynolds, of Glen Mills, Pa., who says: "When I enrolled for the I. C. S. Stationary Engineers Course, I had no knowledge of the theory of my trade. I now have charge of a large heating plant and have increased my earnings 300 per cent, with bright prospects for the future."

Reynolds' salary would never have taken such a jump had he continued along the "rule of thumb" path. Before taking the I. C. S. Course he was paid for what he did with his hands only—now he is paid for what he knows; and, as he says, "with bright prospects for the future."

There's a big financial difference between rule of thumb and rule of mind.

WHAT I. C. S. TRAINING MEANS.

Have you ever realized what I. C. S. training can do for you? Do you realize that it will make you *successful*?

Men in all lines of business everywhere owe their rise in life to the I. C. S. The I. C. S. takes the apprentice and makes him an expert. It takes the underpaid clerk and makes him manager. It takes a man from an uncongenial position and places him at the work he *likes best*.

It gives knowledge and training to the man with little schooling, so that he can meet life on a more substantial footing. I. C. S. training minimizes the struggle for existence—takes men from the line and puts them in the lead—*makes men satisfied, successful, independent*.

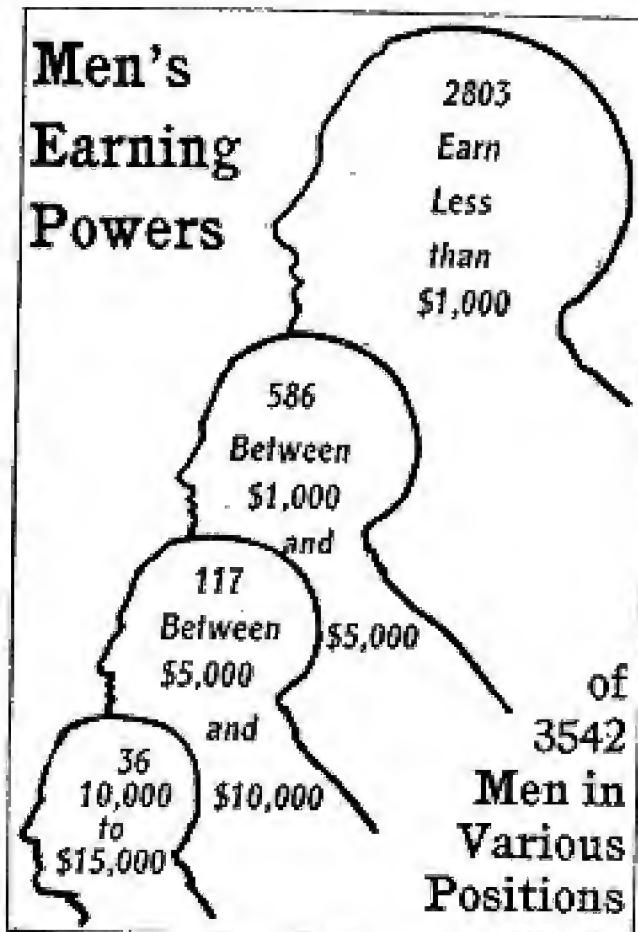
From Machinist to Chief Engineer is a long step—a step that I. C. S. training made short for William P. Harley of 112 Church Street, Charleston, S. C. Mr. Harley says: "While working as a machinist I enrolled with the I. C. S. I would not take any amount for the benefit and knowledge I received from this course. It enabled me to accept a position as Chief Engineer for the Ashepoo Fertilizer Works, and to increase my earnings from \$15.00 to \$30.00 a week."

MACHINIST BECOMES PRESIDENT OF COMPANY.

No more striking example of how the I. C. S. helps men rise from the ranks is to be found than the case of E. A. Bostrom, 51 Houston Street, Atlanta, Ga. It proves beyond any question of doubt that age is no barrier to a man's success. It also proves that I. C. S. training develops a

man's inventive powers so that he can put them to practical use. This is what Bostrom says:

"I was working in a machine shop when I heard of the I. C. S., and although considerably advanced in years I decided to enroll. The training I received enabled me to advance to foreman, then to superintendent. I then invented a simple levelling instrument which I patented, and I am now President of the Bostrom, Brady Mfg. Co. My income, of course, has been greatly increased, and I shall never forget the day I entered your Schools."



dent of a manufacturing company—with an increased income.

THE I. C. S. CAN ALSO HELP YOU.

The I. C. S. took W. F. Sampson, of 1309 Santa Clara Ave., Alameda, Cal., a clerk in a small hardware store, and enabled him to rise to the position of consulting accountant and systematizer in one of the largest flour mills on the Pacific Coast, with an increase of salary of over 200 per cent.

The I. C. S. took C. E. Handshy, 315 Luckroad, Zanesville, Ohio, and helped him to the position of draftsman and super-

intendent for R. H. Evans & Co., Toledo, Ohio, where his salary was doubled within a month.

It took a grocer's clerk and advanced him to the position of mechanical draftsman at nearly four times the salary. His name? Fred W. Kummert, 143 Mt. Pleasant Ave., Hamilton, Ohio.

It took a bricklayer earning 40 cents an hour and *in a short time* enabled him to enter into partnership with his father in the contracting business, where he now earns \$3,500 a year. This young man, J. J. Isrigg, of Greensburg, Ind., says: "I think your instruction is wonderful. I have been quite successful in planning buildings." Think of it!—from laying bricks to planning buildings.

It takes a stationary engineer and makes him an *editor*. This is exactly what it did for Warren O. Rogers of 16 Garden Ave., Cleveland, Ohio, who says: "I enrolled when I was working as stationary engineer. I am now employed as associate editor of the *Engineer's Review* of Cleveland, and am earning *nearly three times over that which I received when I took up my course*. I consider my present success due to my ambition to get ahead and the means that your course provided for my realizing my ambitions."

It made a Patent Office Draftsman of H. O. Rastetter of 617 Cassilly Street, Canton, Ohio, who took the I. C. S. Course while working as an apprentice in a steel roofing establishment. Rastetter says: "I am now Patent Office Draftsman, employed by F. W. Bond, and my salary has been increased nearly 275 per cent. I recommend the I. C. S. to any ambitious young man."

WHAT ARE YOU GOING TO DO ABOUT IT?

Now, how does all this affect you? You can't dodge the fact that training pays—and *pays well*. You can't deny that there's a big demand for the *trained* man. You cannot but admit that at best the position of the *untrained* man is ever a precarious one. And right here you have been given abundant proof that the I. C. S. *can and does* help poorly paid but ambitious men succeed.

It doesn't matter who you are, what you are, what you do, what your color, race, religion or nationality. It makes no difference whether you live in a crowded city or in a quiet country village thousands of miles off. There is nothing whatever to hinder you from becoming an expert in your chosen occupation through the help of the I. C. S. All that is necessary is the ability to read and write. The I. C. S. doesn't look for the man with the big bank account.

OPPORTUNITY AND THE MAN.

Opportunity is said to knock but once. This may be *your* chance to rise from a humdrum "dollar-a-day" existence to a position where your talents, properly trained, will receive recognition and reward.

It is for you to say *NOW* whether you will take full advantage of the opportunity thus offered—whether you will remain in the "down-and-out" class or rise to a position that will bring you happiness in your working days and comfort in your old age.

Be a rolling stone. Who wants to gather moss? Take the first step today—this very minute—by selecting your occupation, marking it on the attached coupon and mailing the coupon.

This is Opportunity—are you the Man?

International Correspondence School's

Box 872-W, SCRANTON, PA.

Please explain, without further obligation on my part, how I can qualify for a larger salary in the position before which I have marked

Bookkeeper
Stenographer
Advertisement Writer
Show Card Writer
Window Trimmer
Commercial Law
Illustrator
Civil Service
Chemist
Textile Mill Supl.
Electrician
Electrical Engineer

Mechanical Draftsman
Telephone Engineer
Electric Lighting Supl.
Mechanical Engineer
Surveyor
Stationary Engineer
Civil Engineer
Building Contractor
Architect
Architect
Structural Engineer
Banking
Mining Engineer

Name.....

Street and No.

City..... State.....



PALM-STEM PORCH CHAIRS

In California palm-leaf stems are thrown away as waste material because of the sharp prongs along the edges. With a little ingenuity many useful articles can be made from them. The chair shown in this illustration was made by an old man, 70 years of age. He makes two a day, the material costs him nothing, and he sells them for \$2.50 each.

BEES BUILD MODEL HOUSE OF HONEY

One of the curious and interesting exhibits at the Missouri Inter-state fair was the model of a 2-story building



Built by Bees

constructed of honey, which was placed by the bees themselves. A rough model of the building, 5 ft. long, 2 ft. wide and 3 ft. high, was placed in a large box or hive with a swarm of bees. At the end of 42 days the bees had completed the work by filling in all the parts with honey.

The electrification of the St. Clair river tunnel at Port Huron, commenced a year ago, is now practically completed at a cost of \$1,000,000.

GIANT STERN FRAME FOR COLLIER

The stern frame of the new collier "Malden," built for the transportation of coal between Boston and southern ports, is a giant in construction. The dimensions of the frame are: Length of rudder post, 36 ft. 8 in.; length of propeller aperture, 21 ft. 8 in.; width of propeller aperture, 7 ft. 5 in. The frame weighs 13½ tons.



13½-Ton Stern Frame

WONDERFUL

Edison Phonograph Offer

At any time you wish you can have a free concert in your own home—not a concert of one instrument or voice alone, but a concert of band and orchestra music, vocal solos, grand opera as well as comic opera—*anything you like*.

This is the regular Standard Phonograph with the regular horn—a fine outfit—but we furnish besides at only a slight extra expense our Parlor Grand Equipment. This we describe fully in our free catalog and circular.

Thomas A. Edison



Mr. Edison says:

"I want to see a Phonograph in every American Home."

FREE TRIAL!

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INVESTOR'S REVIEW, 1461 Gall Bldg., Chicago, Ill.

THE WANING HARDWOOD SUPPLY—although the demand for hardwood lumber is greater than ever before, the annual cut to-day is a billion feet less than it was seven years ago. In this time the wholesale price of the different classes of hardwood lumber advanced from 25 to 65 per cent. The cut of oak, which in 1890 was more than half the total cut of hardwoods, has fallen off 35 per cent. Yellow poplar, which was formerly second in point of output, has fallen off 35 per cent, and elm has fallen off one-half.

The cut of softwoods is over four times that of hardwoods, yet it is doubtful if a shortage in the former would cause dismay to so many industries. The paper, furniture, and vehicle industries depend upon hardwood timber, and the railroads, telephone and telegraph companies, agricultural implement manufacturers, and builders use it extensively.

This leads to the question, Where is the future supply of hardwoods to be found? The cut in Ohio and Indiana, which, seven years ago, led all other states, has fallen off one-half. Illinois, Iowa, Kentucky, Michigan, Minnesota, Missouri, New Jersey, Tennessee, Texas, West Virginia, and Wisconsin have also declined in hardwood production. The chief centers of production now lie in the Lake States, the lower Mississippi Valley, and the Appalachian Mountains. Yet in the Lake States the presence of hardwoods is an almost certain indication of rich agricultural land, and when the hardwoods are cut the land is turned permanently to agricultural use. In Arkansas, Louisiana, and Mississippi the production of hardwoods is already at its extreme height, and in Missouri and Texas it has already begun to decline.

The answer to the question, therefore, would seem to lie in the Appalachian Mountains. They contain the largest body of hardwood timber left in the United States. On them grow the greatest variety of tree species anywhere to be found. Protected from the hot, reckless cutting, they produce the best kinds of timber, since their soil and climate combine to make heavy stumps and rapid growth. Yet much of the Appalachian forest has been so damaged in the past that it will be years before it will again reach a high state of productiveness. Twenty billion feet of lumber would be a conservative estimate of the annual productive capacity of the 75,000,000 acres of forest lands in the Appalachians if they were rightly managed. Until then are we to expect a shortage in hardwood timber.

Circular 118, of the Forest Service, entitled "The Waning Hardwood Supply," discusses this situation. It may be had upon application to the Forester, Forest Service, Washington, D. C.

BRICK FOR HOUSE BUILDING—One of the greatest advantages of brick for house building is that it can be bought nearly everywhere as a home-made material. Almost every town and village has its brickyard, by which it is possible to escape the added price of freight. A brick wall is substantial, dry and non-conducting. It can be made attractive in texture by various whitings and colors in the joints. Brickwork is dependent on no other material for its foundations, but is sufficient in itself.

A brick wall never needs paint. If it ever does become slightly, brush it down with a weak solution of muriatic acid, but don't paint it any more than you would paint stonework.

SCHOOL TEACHES SKYSCRAPER CONSTRUCTION—A school has been started in New York by the Young Men's Christian Association for the express purpose of training young men in the work of skyscraper building. Instruction is given in structural engineering, structural drafting and detailing, estimating, reading, and general building construction.

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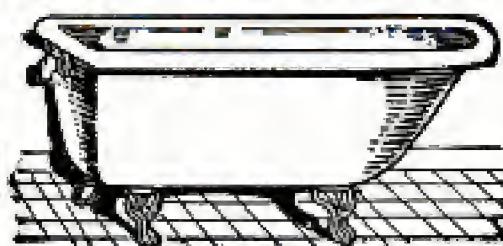
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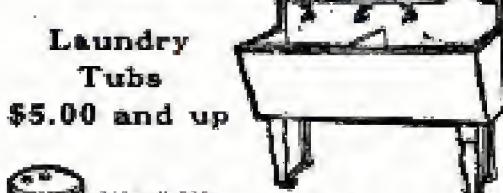
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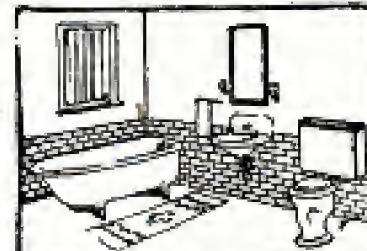
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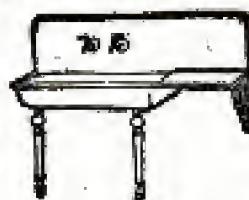
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THIS IS YOUR CHANCE

The time is fast approaching when iron castings, both grey and malleable, must give way to soft and hard steel castings—conditions of strength and durability demanding the substitution of the superior product. The U. S. Steel Company has demonstrated the immense profits to be made from steel manufacture. Three years ago its common stock could be bought for 9 cents on the dollar; today it is 22 cents, and at no time has there been any danger of loss or failure in this great industry. Steel is as staple as corn, wheat or cotton, and less liable to fluctuations in price, because the production is easily controlled.

One of the most important branches of the steel industry, and one that is in its infancy, is the making of specially hardened steel castings. They are to ordinary steel castings what malleable iron is to grey iron. The Armor Steel & Foundry Co. is turning out steel castings by a process discovered by a man named Gebhard, in which a hardened surface is produced on a soft steel base. This surface may be from $\frac{1}{8}$ to $\frac{3}{4}$ of an inch in depth and applied at any desired points of the casting. The surface coating is not brittle, but tough, and the result is the life of the casting is increased from six to seven hundred percent, while the additional cost of producing the hardened castings is nominal.

This process has been used by the inventor at the Joliet mill of the Illinois Steel Co., and he received a royalty of \$5.00 per ton on all castings produced under the process. The Armor Company is now the sole owner of all rights to this process, and at its foundry at Matthews, Ind., is turning out castings for the Illinois Steel Mills; the National Tube Co., of Pittsburg; American Sheet & Tin Plate Co., Pittsburg; Detroit Steel Tube Co., Detroit; Cambria Steel Co., Johnstown, Pa.; American Ship Building Co., Cleveland; Jones & Laughlin Co., Pittsburg; Pressed Steel Car Co., McKees Rocks, Pa.; Dayton Steel & Iron Works, Dayton, Ohio, and many others.

The following letters from the men who know, show the merits of castings produced by the Gebhard process:

Illinois Steel Company, Joliet, Ill.
Joliet, Ill., May 18, 1900.

Armor Steel & Foundry Co.

Dear Sirs: In reply to your request relative to the merits of the Gebhard process for hardening wearing surfaces of steel castings, I beg to say we have been using it in the mills here successfully for four years on spike and roller cams, cams for blow engines, spur-gears, bevel and miter gears, friction wheels for our hydraulic 40-ton traveling cranes, wheels for hydraulic cranes, and for pawls on hydraulic steering guides for rolls, hardened by the Gebhard process, and have demonstrated in a practical way, that this has prolonged the life of the castings three times and in some cases much longer. I can't say too much in its favor for automobile spike machine cams, and we find the use of the process is practically unlimited.

George Burgess,
Master Mechanic.

Joliet Works, Illinois Steel Co., Joliet, Ill.
Joliet, Ill., Oct. 8, 1900.

Armor Steel & Foundry Co.

Mr. Howes: I received yours of Sept. 21st. With regard to the Gebhard process of hardening gears. It is all right; we have been using them in the mill for the last year.

We put a set of hardened gears on the bloomable last December; they are as good as when we put them in. We have changed soft gears in the same place about every month or six weeks.

With regard to how long hardened gears will last, I cannot say, as there don't seem to be any wear yet to them.

H. Reid,
Chief Engineer, Bloom Mill, Illinois Steel Co.

The Armor Steel Foundry Co., in order to increase its equipment and thereby meet the demands for their castings, has placed with me to sell \$100,000 worth of stock at 25 cents on the dollar, at which price \$25 will pay for \$100 worth of stock, and no subscription will be received for less than \$25. The stock is non-assessable, and there is no preferred stock or bonds. The foundry at Matthews, Ind., is worth \$50,000 and, as Master Mechanic Burgess says, "the use of the process is practically unlimited."

A great deal of the stock of this company is held by steel men who are familiar with the products turned out and know the demand that exists for same. There are no high-salaried officers to eat up profits, no expensive experiments to be carried on, the business being just making steel castings for the trade.

As rapidly as conservative management will justify, additional foundries will be built in sections where there is a sufficient demand for these process hardened castings, and stockholders in the Armor Company will participate in the profits of the subsidiary companies.

Now, this is your chance to make a safe and profitable investment of a small amount of money. If the amount offered is oversubscribed the company reserves the right to scale the subscriptions so that each purchaser will receive his proper pro rata number of shares.

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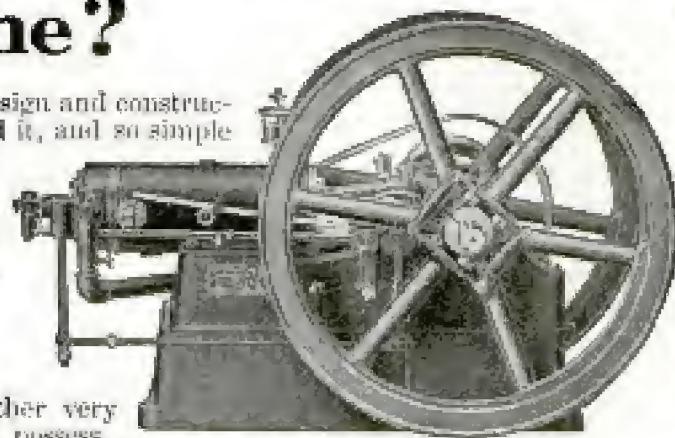
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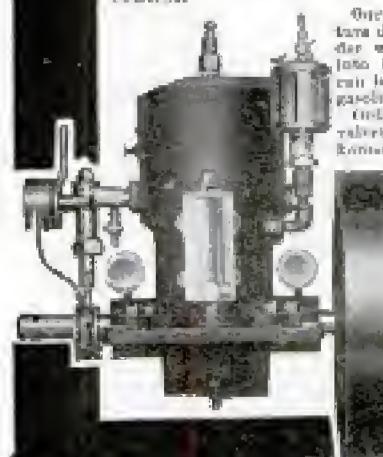
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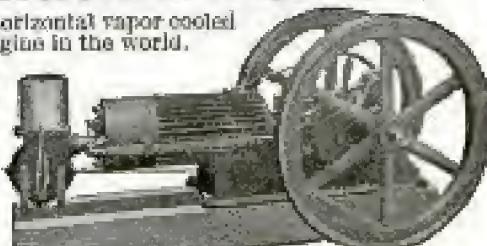
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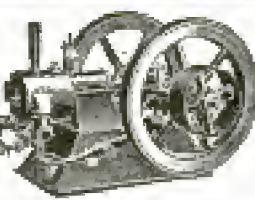
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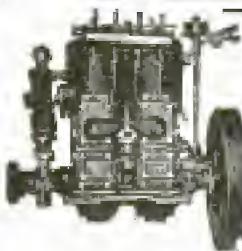
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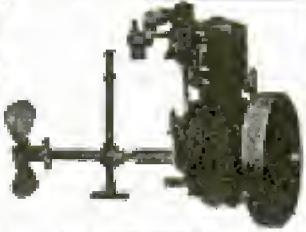
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IMPRISONED IN BOILER WITH FIRE UNDERNEATH—Imprisoned in a big boiler, underneath which a fire was gradually heating the dues to a point which would have meant a horrible death if his escape had been delayed but a few minutes longer, is the experience recently undergone by Arthur McDonald, a young boiler-maker of Arkansas. He has just left the hospital, a nervous wreck. His hair, which was coal black, now hangs over his forehead, a soft, glistening white.

The experience occurred at a saw mill at Hope, Ark. A new set of boilers had been put in, and negro firemen were relied upon to attend them. Something went wrong, and McDonald was called upon. After closing the first boiler, he ordered the firemen to fill it with water and build a fire under it, when they had finished the work they were then doing. McDonald then entered the second boiler, and had been working about an hour, when he noticed his enamele growing dim, and started to investigate. He found that the manhole cover had been replaced, and, sick with horror, realized that the negroes had misunderstood his orders and were building a fire underneath him. A moment later he heard the rush of water and frantically called for help and struck his hammer against the sides of the boiler, hoping to attract their attention. Soon the heat began to be felt. He touched a fire and started back with a gasp. It was warm—ever so slightly, but warm, nevertheless.

With hands torn and bleeding, and eyes almost bursting from their sockets, the now thoroughly crazed man crawled back and forth in his prison, panting, praying and moaning. The dues became so hot they burned his feet, and his head swam with the heat.

At last more dead than alive, he threw himself down on the dues to hasten the end, and then at almost the last moment a way of escape dawned upon him. Grasping his chisel, he placed it against one of the dues under water and dealt it terrific blows, driven by frenzy. The first blow missed, and, striking his little finger, smashed it off. The other blows tell true, and the chisel broke through the due, letting the water follow. The negroes heard the water when it struck the fire, and, believing that the boiler still leaked, opened the water plug and raked out the fire.

McDonald had a faint recollection of a patch of daylight when the manhole was opened, but knew nothing more for five days.

PLAN TO LIMIT THE HEIGHT OF SKYSCRAPERS—The race among builders for the honor of putting up the tallest skyscraper may be brought to a sudden end by drastic regulations which have been adopted by the building code revision commission of New York. These regulations, slated for adoption in January, provide that no new building shall be over 250 ft. in height. The new code will not prevent the construction of reasonably tall buildings. The Waldorf-Astoria hotel, regarded by many as tall enough for any building, would be able to add at least three more stories to its present structure before overlapping the limit. Buildings of 20 stories could easily be kept within the limit.

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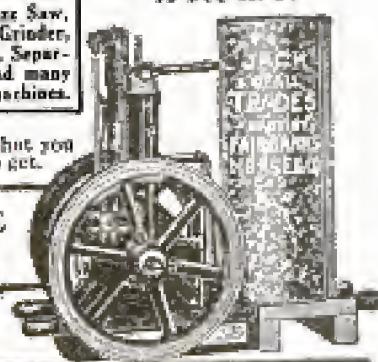
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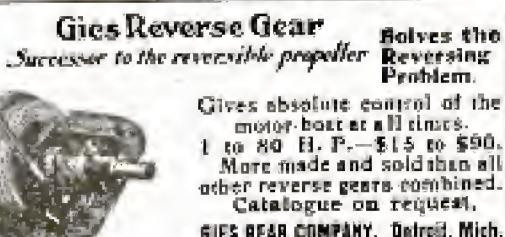
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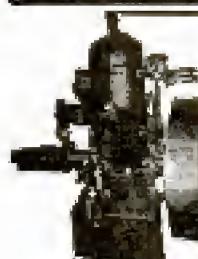


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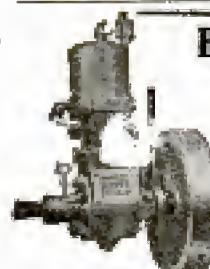
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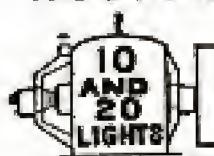
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ADVANCES IN THE ELECTRIC INCANDESCENT LIGHT

—The electric incandescent light is undergoing a great change. Carbon is being replaced by metal wires. It has been found possible to make wires of high enough resistance of tungsten, osmium, tantalum, and a few other metals and compounds. The carbon lamp was the first of these, but there was difficulty in making it of high enough resistance. The tantalum lamp is now in great demand. It is made for 100 to 120 volts, and is much more efficient than the carbon lamp. It will not last long on alternating currents, however. The wires of a lamp that have been run for some time on a direct current show a curious notched or crinkled appearance under the microscope. But a wire that has been run on an alternating circuit looks as if the metal had been melted into short cylinders with round ends, and these cylinders had stuck together end to end without their centers being in a line. Sometimes the little cylinders are nearly separated, merely touching at a corner. This action is very extraordinary, and has never been explained. In addition to this, when a lamp breaks down on an alternating circuit, the wire sometimes goes at one point, and sometimes it breaks in several places, and tangles itself up in an extraordinary way; at other times it breaks up into numerous little pieces, which will be found lying on the inside of the globe. Some of the other lamps show a change under the action of the current, but it is not so marked as in the case of tantalum.

One of the most interesting of the new lamps is the Zircon. It is said to be made of zirconium and tungsten and lamps of this material have been made for 200 volts, a matter of the greatest importance from a distribution point of view. It is possible that the conductor is really a zirconium of tungsten, and this opens up a new series of compounds. A Zircon lamp for 100 volts has really separate loops of wire mounted in series inside a bulb. A recent improvement is to provide an extremely light spring for each loop, so as to keep it taut. The lamp can then be used in any position.

Tungsten seems to be the favorite metal, as it gives a very high efficiency. It is probably the lamp of the future, will have an efficiency of nearly a candle per watt, and this is promised by the use of tungsten. At the same time it must be admitted that to make a wire with a resistance of 500 ohms small enough to give 20 candles with 20 watts is a triumph of inventive skill.—J. Swinburne, Chemist.

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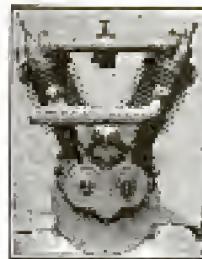
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TRANSPLANTING ELECTRIC LIGHT TOWERS—One by one the tower lights so long a feature in the downtown districts of Detroit, Mich., are being taken down and removed to the outskirts. The advent of skyscrapers and the heavy growth of foliage in the sections where the towers used to stand their rays played a prominent part in hastening the departure of these landmarks. The work of taking down the iron towers, 150 ft. high, is done from the bottom upward. As each section is taken off the tower is lowered until the lamp platform is reached. Only two or three of the towers are now left in the downtown districts, and as rapidly as possible they will be transferred to the outlying districts.

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SAVED BY A SONG—Several years ago, on one of the eastern coast bays, when, as yet, steamers were infrequent visitors, a small boat used to ply, touching at various points. The crew was somewhat limited, consisting of the captain, first mate—whose name was Barnabas—and the cook.

The cook was afflicted with an impediment in his speech, which made him somewhat backward himself, especially if excited. Fortunately, however, he could sing as straight as anyone. One day the captain was below, taking a nap, while Barnabas and the cook were running the boat. A sudden squall brought the boat around with such unexpected violence as to knock the captain overboard. The cook John rushed into the cabin in the wildest excitement to inform the captain of what had occurred, but was unable to get out a coherent sentence. "B-i-b-i—" he stammered, until the captain, in a rage, shouted: "Thunderation! man, sing it, if you can't say it!" and John, catching at the happy suggestion, sang: "Half a mile astern of us,

Overboard is Barnabas."

The boat was immediately put about, and the luckless Barnabas rescued.



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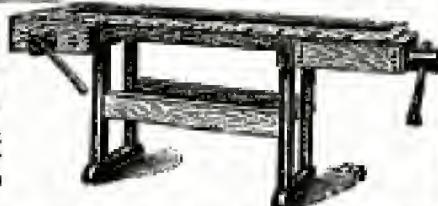
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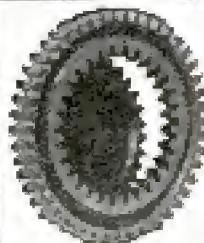
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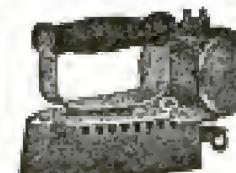


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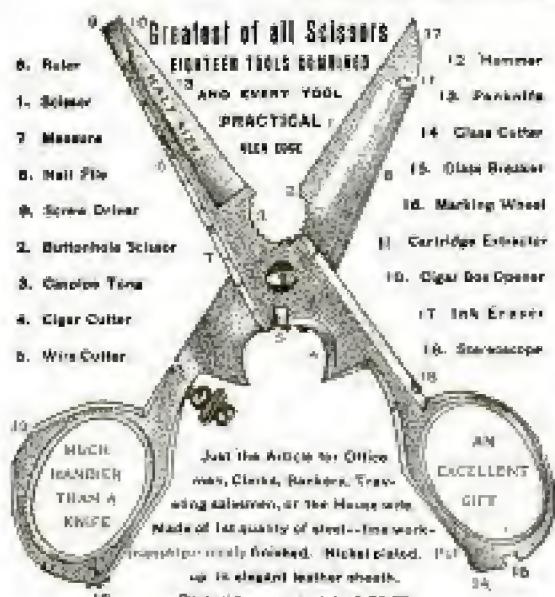
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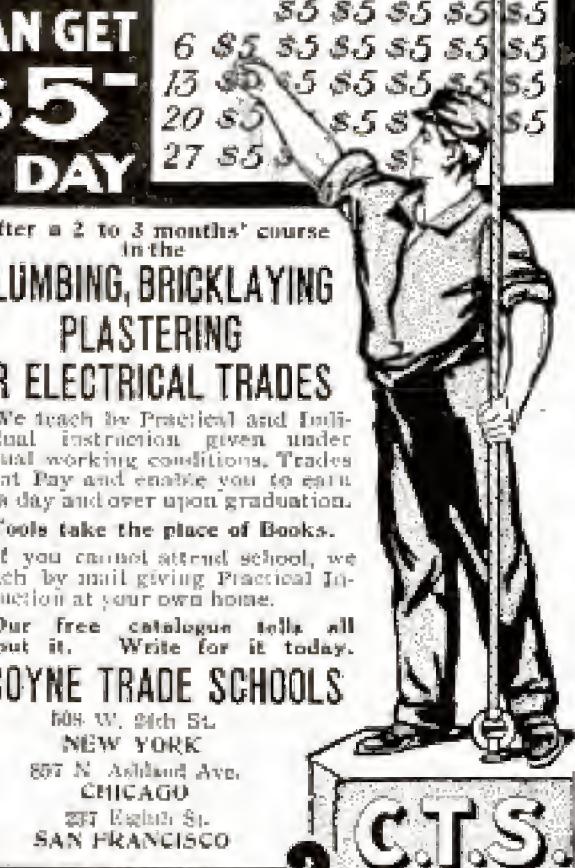
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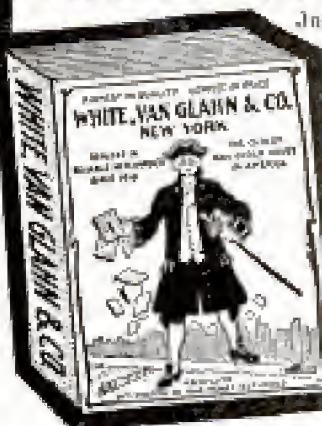
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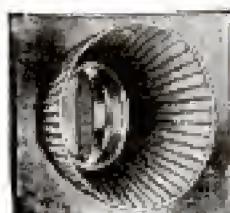
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ADVICE TO INVENTORS—The maxim that "A little learning is a dangerous thing," is especially applicable to inventors, as may be seen upon investigation of the patent office records in relation to almost any branch of industry. For example, the records of patents granted on "Improvements in brakemobiles" show one case where a patent was for a brakemobile provided with oilways on the face and with an oilcup mounted on the back of the shoe, the idea being to lubricate the rubbing surfaces in order to prevent rapid wear of the shoe. Another patented brakemobile was designed to have a set of rollers on the foot so that the anti-friction bearing thus provided would greatly reduce the wear of both shoe and wheel. Naturally, the patentees of such devices would believe that failure to adopt them was due entirely to prejudice, and perhaps it will be found that the investigation which it was announced some weeks ago was to be undertaken by the block signal and train control board under the direction of the Interstate commerce commission into the charges that an association of manufacturers had combined to suppress meritorious patents which would result in the improvement of operating conditions on railroads, was instigated by promoters of devices analogous to the brakemobile cited. Those who have even the slightest acquaintance with the vast sums of money which the manufacturing concerns of America are spending on patents which promise well, but which turn out to be worthless, find absurd the suggestion that meritorious inventions are deliberately suppressed.—Editorial in *Railway Age*.

ANTHRACITE COAL CENTENNIAL—An appropriate celebration of the centennial of anthracite coal is being considered by the citizens of Plymouth, Pa. In 1807 the first shipment of "black stone" was made by boats down the Susquehanna River. This day marked the beginning of the use of hard coal. It was the discovery that hard coal must be freed from every impurity and crushed to a uniform size before it could be successfully burned which started the great industry that this year will probably have an output of 70,000,000 tons.

Unlike soft coal, which can be dumped into cars at the shaft of the mine and directly transported to the consumer, hard coal requires preparation for market almost as complicated as the manufacture of flour from wheat. A long series of processes and washings are necessary to produce the accurately sized pure coal. As it comes from the mines it varies in size from a lump as large as a watermelon to sizes no larger than a walnut. Every lump is examined by men who are experts in detecting layers of slate or other impurities which look just like coal. The lumps are cracked with axes and every vestige of unburnable material removed before the coal is passed on to be crushed and sorted into the different sizes.

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Mr. Parker on November 1, 1902, after having been a member of the Examining Corps of the U. S. Patent Office over five years, resigned his position as Examiner to take up the practice of Patent Law.

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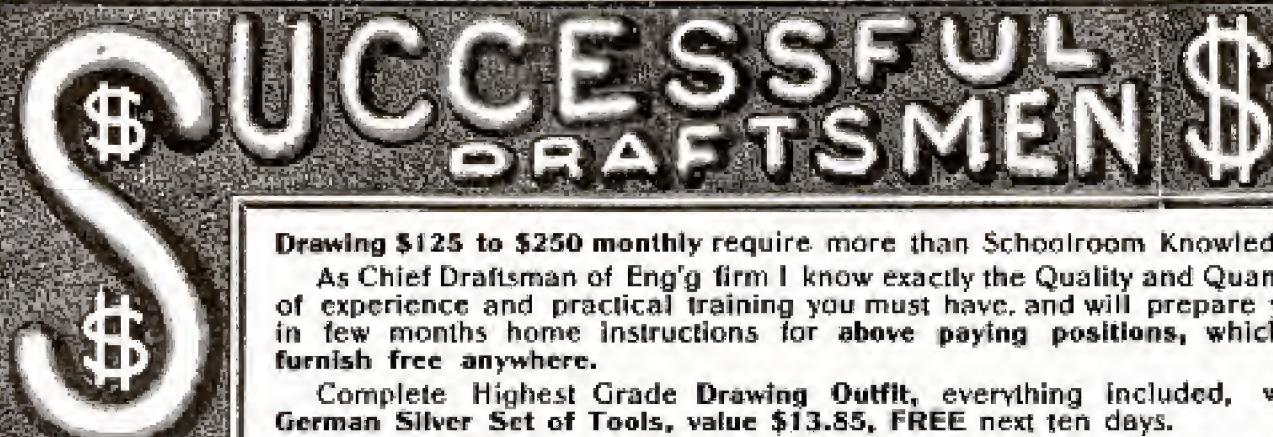


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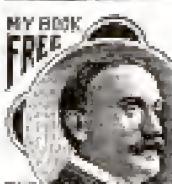
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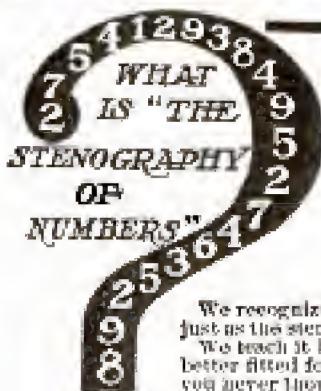
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NO PASSES FOR RAILROAD'S DEAD—The ruling made on the anti-pass law by the Texas attorney-general, in answer to questions asked by the attorneys of one of the railroads running through that state, has brought the fact that free transportation cannot be furnished the body of an employee killed on the line away from home. The body cannot be taken from place of death, place of burial free, nor can relatives, other than immediate relatives of the dead employee, be furnished transportation to come to the funeral.

Not only in these two instances does the law prohibit the simplest acts of duty and humanity toward an employee or his family, but it even prohibits the railroads from carrying free to any other part of the line wife and children, or the household goods. If such services are rendered by the railroads the expense entailed must be deducted from the damage settlement, if there is any, or by the road itself in real money. This law seems to work both ways, at least as interpreted by the Texas jurist.

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CONCRETE WALLS DAMP?—An old man who is a contractor in the making of concrete blocks said: “I heard brick men talk about the dampness of concrete walls, and when one of them recently advanced this to me, I answered, ‘If you are right, how is it that contractors all place a coating of cement plaster over brick walls in foundations, so as to keep out dampness?’”—Concrete.

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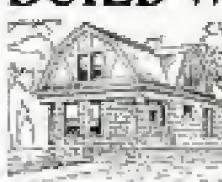


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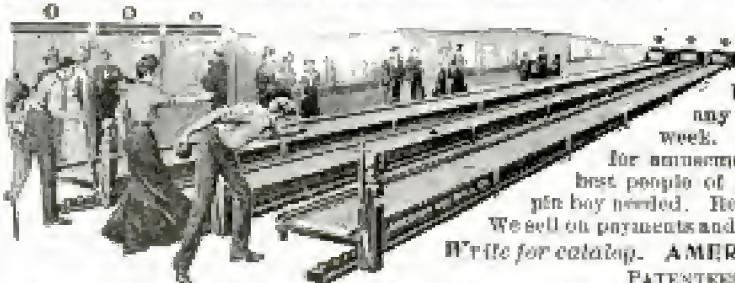
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SEWS UP WOUND BEFORE HE FAINTS—"Get me a needle and thread, quick, or I'll bleed to death," demanded James Cassidy, when his right forearm was terribly mangled by machinery at the Edystone Print Works.

Needle and thread were brought, and Cassidy calmly sewed up the wound, which was 4 in. in length.

"Now send me to the hospital, and I guess the doctors can fix me up a little better," was Cassidy's injunction as he swooned. Dr. Frank J. Evans, the company's physician, says he has never seen anything to equal the man's pluck during his twenty-five years' experience as a practicing physician.—Philadelphia North American.

OYSTER FARMS IN JAPAN—In the United States the gathering of oysters is spoken of as a "catch." In Japan, however, this could not apply, as the oysters are really a crop, cultivated as carefully and systematically as any production grown on dry land.

The Japanese use vast quantities of bamboo brush in breeding and growing their oysters. At low tide in the Sea of Aki, the network of straits and river mouths bristles with closely set oyster farms. Most of the bamboo stakes used retain their smaller branches, and as various patterns are affected by the oyster growers in setting the stakes to control the tide currents for the benefit of the feeding oysters, the low-tide view of an oyster farm is startling and beautiful. Seen from a distance, it looks as though some ocean workmen had been constructing a featherly city, symmetrical and exact.

One of the most interesting features of the industry is the fact that the government surveys the farms and rents them by auction to the highest bidder. The tenant during his lifetime has the right of renewal of lease, but only for so much of a farm as he can work himself. This leaves no gate open for speculation.

RAILROAD ONLY 317 FT. LONG—The shortest railroad in Louisiana—probably the shortest in the United States—runs from Burnside station, on the Yazoo & Mississippi Valley Railway, to Homan's Landing, 317 ft. away. The rolling stock of the road consists of an old street car, formerly used in New Orleans, and the motive power is a pale bay mule. Capt. P. T. Badin is owner, and the engineer is generally picked from the field hands of a big plantation close by. The line is used to convey passengers from the railroad station to the steamboat landing. The distance is merely a trifle over a block, and passengers never fail to quiz the road and its management, from the president down to the driver of the mule. No fares are collected.

IT PAYS TO BE CAREFUL—An enthusiastic motorist, on approaching a turn in the road where a number of children were at play, told his chauffeur to slow down. Fearing that the chauffeur would misunderstand, he tried to square himself in the following manner: "I don't at all mind about running down grown-up people and dogs, but do be careful about the children and babies."

"Yes; them feeding bottles do cut up the tires dreadfully," the chauffeur replied.



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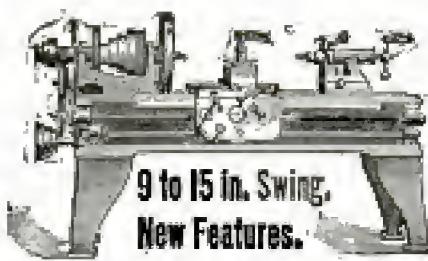
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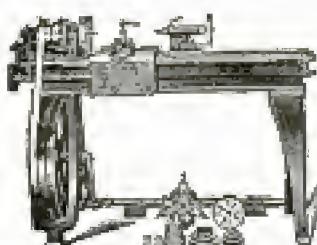


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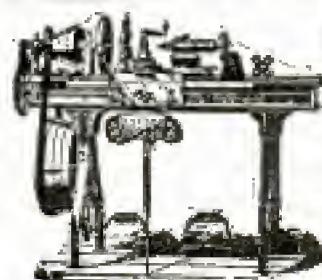
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Photographs of new and interesting subjects, suitable for publication in this magazine, may be submitted to its editor and those accepted will be paid for promptly.

Editor Popular Mechanics
160 Washington St. Chicago

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CAN CARRY AN ARMY—German army officers seem greatly perturbed over the possibilities of the "Lusitania" and her sister ship, the "Mauretania," as army transports. The two ships, they say, could transport an army of 20,000 men from England to the continent in very short order, if the necessity should arise. The officers and crews are members of the British naval reserves, and the vessels could be turned over to the admiralty with but very little preparation.

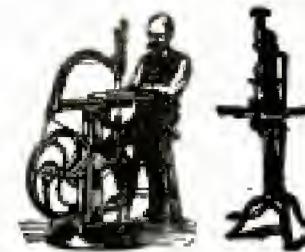
LIFTING A 360-FT. DRAWBRIDGE WITHOUT TOOLS was accomplished under the pressure of necessity in a very ingenious manner some years ago. A recent report of how a battleship's turret was made to lift itself by its own hoisting power has resurrected the story. About 14 years ago a draw span 360 ft. long crossing the Ouachita River, on the Houston, Central Arkansas & Northern Railroad, near Columbia, La., built on a pile and concrete foundation, settled on one side, throwing it out of line. Mr. E. F. Terry was sent down to correct the trouble. The bridge was in a jungle hundreds of miles from a city, and Mr. Terry had absolutely no tools. Some old stovepipe iron found on the site of the old construction camp was placed under the track, one piece at a time, and the drawbridge was then turned backwards and forwards, being raised by the thickness of one piece of the sheet metal at each operation. After bringing the bridge up to proper grade, he raised the different track segments to the proper level, and then tamped a rust joint under each segment. This was done with four men to assist him, in about a week's time.—Engineering News.

FAST LOCOMOTIVE—A firm in Munich has built for the Bavarian State Railways a locomotive capable of hauling a train weighing 165 tons at a speed of 100 miles an hour. This engine was tested on July 1 and 2, and it is said, maintained for a prolonged time a speed of 96 miles an hour, which is declared to be the greatest speed ever made in Europe by a steam locomotive. It is a four-cylinder compound with 4-ft. drivers, and fitted with a superheater.

ORIGINAL CHAUFFEUR WAS FIERCE—That the modern chauffeur often develops a reckless disposition is not to be wondered at, when one reads his ancestry as told in Motor Print, London, which says:

"History tells us that along about the year 1795 there sprang up in France, principally in the eastern and central regions, fantastically dressed men with their faces blackened with soot and their eyes carefully concealed, who gained admittance to farmhouses and other isolated dwellings at night and committed all kinds of depredations and outrages. These silent hold-up artists had an atrocious habit especially, from which they obtained the name that posterity has preserved for them. They first garrisoned their victims, and dragged them in front of a great fire, where they burned the soles of their feet. Then they demanded of them where their money and jewels were concealed. Such interrogatories could scarcely be resisted. It is from this that is derived the appellation of chauffeur, which once so terrified old ladies."

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Exclusive territory to good agents.
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SELL WHAT YOU DO NOT NEED

Few things except land increase in value with age. Don't keep on piling up junk in your factory, home or office. Somebody can use it and wants it if only they knew of what is to them an opportunity, and to you a conversion into cash of an otherwise useless article. You can fill your want, or sell the article, by a few words in our classified pages. (3 cents a word.)

WHY DON'T YOU TRADE?

The exchange of something you no longer need for something else you do want is a ready and sane means of making two people pleased. There are scores who want what you do not and who have what you desire. Why not exchange? You two who don't know where the other is, can quickly get together in our classified pages. (3 cents a word.)

No matter what you want, from an album to an airship (both have actually been sold through our classified ads), you can find it in two or three lines in our classified pages. (3 cents a word.)

Our classified ads are about as cheap in price and as prolific of the result for which the ad is intended as any advertising in any tongue or place.

A 3-line ad in the December issue, containing 20 words, was printed in 122,000 copies, which certainly will be read by 244,000 people, and the cost is 60 CENTS. In other words, for each cent the 3-line ad is seen by 4,066 readers in all parts of the United States, Canada and Mexico, and a good many in foreign countries.

For instance: A 2-line ad in our October issue, which cost 26 CENTS, brought 120 replies, and seven of them contained checks, drafts or money orders for the purchase. The other 113 replies wanted more information, as the 26 words really did not go into minute details. The article in question was a second-hand typewriter.

Turn to the classified pages; they are good reading.
Try a classified ad yourself next month.
3 cents a word—for one time—3 cents a word.

POPULAR MECHANICS,

— — —

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2¢ A WEEK.
Operates this lamp and gives you a home as bright and cheerful as in any city. Shipped anywhere. Safe delivery guaranteed on receipt of \$6.00.

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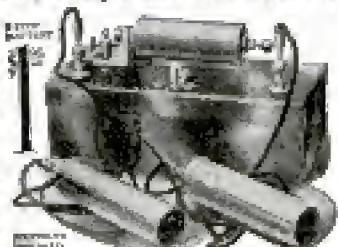
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1908 Models \$10 to \$27
with Counter-Brakes and Fracture-Proof Tires.
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all of best makes
500 Second-Hand Wheels
All makes and models. **\$3 to \$8**
good as new
Great Factory Clearing Sale.
We **Ship On Approval** without a cent deposit, pay the freight and allow
TEN DAYS' FREE TRIAL.
Tires, counter-brakes, parts, repairs and sundries, half-fusal prices. Do not buy all, get our catalogues and offer. Write soon
MEAD CYCLE CO., Dept. PM Chicago



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Magic Foot Drafts are so sure to cure that we gladly send them to anybody Free on approval and wait for our pay until the work is done. Send us your name today. Return mail will bring you a regular dollar pair of Drafts, prepaid, to try free. Then if you are satisfied with the benefit received, you can send us One Dollar; if not, they cost you nothing. You decide. You can see that we couldn't afford to make such an offer if the Drafts didn't cure. Address Magic Foot Draft Co., 151 Oliver Building, Jackson, Mich. Write today.

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The verses published in the November issue of Popular Mechanics, entitled "The Old Folks at Home," were written by Maxwell Reynolds, Worcester, Mass., who describes himself at the time it was written as a lonely man on a stormy night.

PILE SHARPENING MACHINE—An English contracting firm engaged upon the construction of harbor works in Rotterdam, Holland, has built a machine for the purpose of sharpening piles, which resembles a gigantic pencil sharpener. Piles of 28 in. in diameter are sharpened to a 5-in. point in 15 minutes.

HIGH BELL BUTTONS—Of all the foolish notions recently recorded, the most unthinking is that of the New York architects who are putting the street done push buttons higher than usual, so that they will be above the reach of mischievous small boys. These deluded persons must be so old that they have forgotten all about kids. Otherwise they would realize that it is a mighty poor excuse of a boy that could be circumvented in any such trivial way. As it is a fair inference that the Manhattan boys are like boys everywhere else, a high door bell will present merely an added temptation to their enterprise. The architects would better capitulate to the small boys if they can think of nothing more effective than they have now devised.—Building Management.

CONCRETE IN FREEZING WEATHER—In the construction of dams for Huronian Company's power development in Canada, a large part of the concrete work in dams, and also in power-house foundations, was done in winter, with the temperature varying from a few degrees of frost to 15 degrees below zero, and on several occasions much lower. No difficulty was found in securing good concrete work, the only precaution taken being to heat the mixing water by turning a 3/4-in. steam pipe into the water barrel supplying the mixer, and, during the process of mixing, to use a jet of live steam in the mixer, keeping the cylinder closed by wooden coverings during the process of mixing. No attempt was made to heat sand or stone. In all the winter work care was taken to use only cement which would attain its initial set in not more than 45 minutes.—Engineering Contracting.

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ARMY ENGINEERS RUSHING PANAMA CANAL—astonishing progress has been made in the work on the Panama Canal since the army engineers took hold of the work, in March, 1906. Col. Goethals, the engineer in charge, has not yet had an opportunity to show what he can do in dry weather, but in the face of a rainfall unusually heavy even for the Isthmus, he attained the extraordinary figure of 1,844,000 cu. yd. in the single month of October. He increased the excavation 25 per cent over September, in the face of an increase of 45 per cent rainfall.

On November 1 there remained to be excavated 97,000,000 cu. yd. At the rate of progress made during the month of October, 50 months, or 4 years 5 months, would be required to complete the excavation. Were it not for Col. Goethals' warning that the construction of the massive locks, rather than the excavation of the canal prism, will, from now on, control the date of completion, the opening of the canal might be looked forward to at no later date than the summer of 1912.

AN AERONAUT'S PROSE POEM—Now the clouds shut out from view all that human eyes are used to know, and a new world strange to man is all our own.

We are alone in space, where for eternal years only time has dwelt. Without direction to our way we travel on, for in these regions so remote to all mankind direction is unknown—no east our west nor north nor south does mark our path. The horizon, man's constant friend below, has disappeared, and eyes, hardened by the never-ending distance, give up the quest of limitless space.

Sound fled from solitude so great, afraid to be alone, and even in our care she seems to be afraid, and echoes back to safety from the cloud below. As far as eye can reach the scene is clothed in white, as though the snow of ages, piled on snow of ages gone before, is bleached forever by a never-shaking sun.

Fantastic shapes of splendor undescribed are reared within the time of thought, but for a glance alone, and soon dissolve to give us a chance to view new shapes of greater splendor far, arisen at our side. The sun in splendor undisturbed since placed on high by nature's God shines down through blue which skies impregnable, and will shine on until the end of time shall come and man will be no more.

Faculties brought from below and used to tell us where we are and where we go are all at fault in this strange place, and though we fly as on the winds and with a speed equalled by thought alone, still it is as if we yet stood still and let the sloth pass by, for here no speed is known short of the speed at which the light is launched from worlds unseen and travels yet to meet our sight.—J. C. McCoy.

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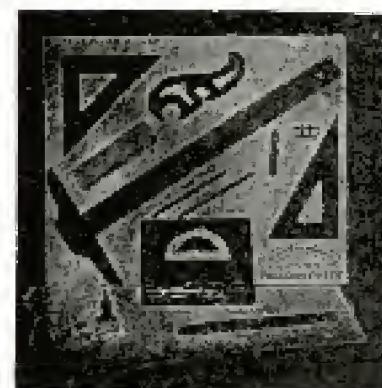
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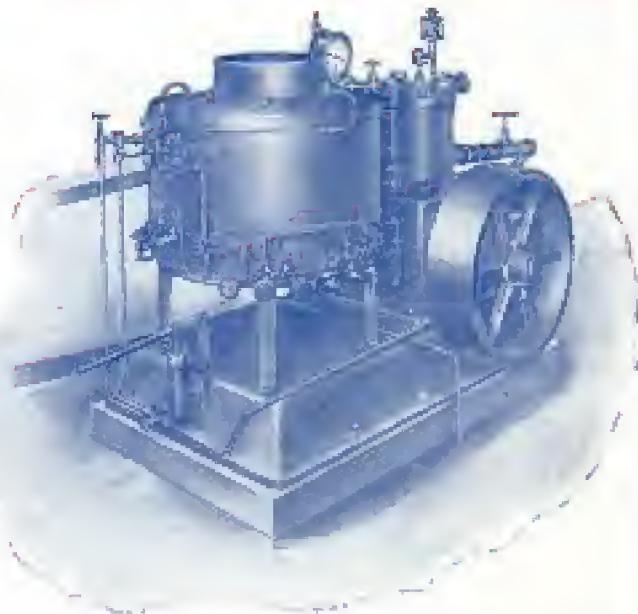
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